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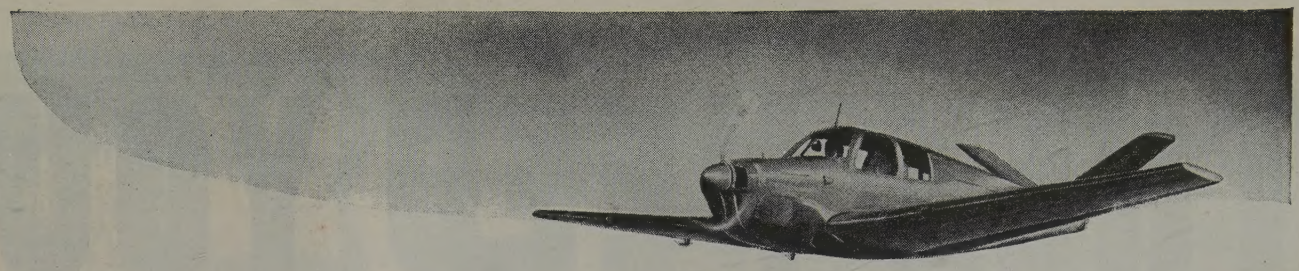

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SKYWAYS

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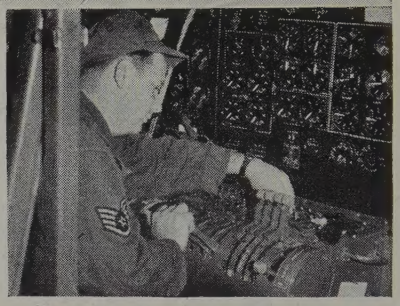
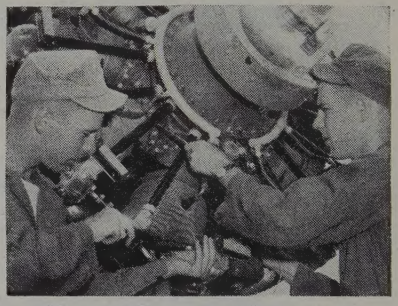


The Air Force needs trained multi-engine Flight Engineers

The Air Force needs trained Ground Control Approach Operators



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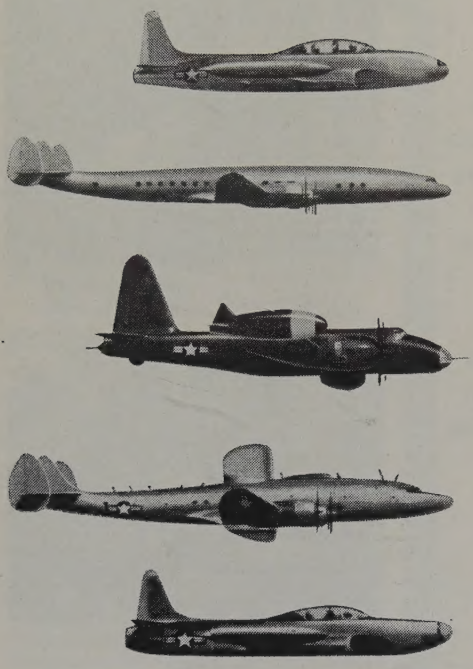

T-33 JET TRAINER
SUPER CONSTELLATION
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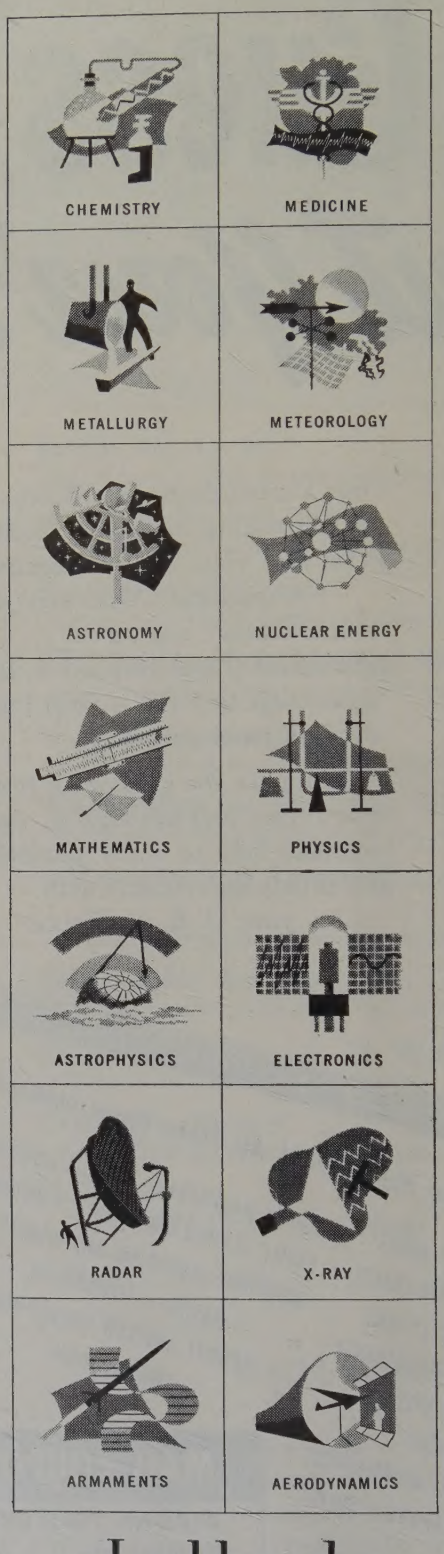
MILITARY CONSTELLATION
F-94 STARFIRE



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Secret and advanced designs of virtually every electronics manufacturer in the U.S. are constantly studied, correlated and put to work at Lockheed Aircraft Corporation's electronics center in Burbank, Calif.

This center is one of the nation's largest clearinghouses for electronics intelligence. It was developed by Lockheed to provide the latest in this science of automatic controls for such Lockheed planes as the F-94, first U. S. All-Weather Interceptor; the WV-1 and WV-2, Navy Constellation radar sentinels; and deadly new models of the P2V Navy patrol bomber for anti-submarine warfare.

Such laboratories as Westinghouse, Hughes, General Electric, RCA, Raytheon, Western Electric, Hoffman and many others bring advanced electronic developments to Lockheed for practical application.

UNIQUE APPROACH

Lockheed's approach to electronics differs noticeably from many other aircraft manufacturers. At Lockheed the emphasis is on the application, not the manufacture, of electronics. That's because Lockheed begins the design of an advanced plane with the specific mission of the plane in mind. Knowing what the plane MUST do, Lockheed wants to be free to analyze *all* products of *all* manufacturers in order to obtain the most advanced electronic devices needed to accomplish this mission.

Lockheed does more than apply *existing* electronics. Often, no device is available to perform a specific job. At such a time, Lockheed scientists provide the all-important idea, frequently supplying the basic design, for a new product. Then they turn it over to an electronics company for manufacture.

TYPICAL EXAMPLE

America's first All-Weather Interceptor, the Lockheed F-94, is a current result of Lockheed's policy. Not being a manufacturer of electronics, noncompetitive Lockheed can work closely with companies who are, as well as the U.S. air services. As a result the F-94 was *electronically at least two years ahead* of competitive aircraft.

This leadership is a principal reason why Lockheed is attracting so many top experts in electronics.

AIR YOUR VIEWS

Downdrafts

Gentlemen:

I read with interest the comments in "Air Your Views," concerning downdrafts in the vicinity of Mount Washington, New Hampshire. Because of the generally high winds and the obstructions offered by the mountain ranges, it is not surprising that the air in the vicinity is turbulent. While I am unable to compare this region with the Sierras, I can comment upon the downdrafts because of my residence during five winters, including that of the high gust (April 12, 1934) and the September, 1938 hurricane.

When the Observatory was re-established on the mountain in 1932, we equipped ourselves with theodolites, hydrogen balloons and a plotting board, not to mention candle lanterns. However, there were probably only one or two balloon flights followed by a single theodolite that meant anything. Invariably, the pilot balloon went downhill into Pinkham Notch on the eastern slope (prevailing winds are westerly), usually rising only along the slope of the next (Carter-Wildcat) range. I believe the balloons tended to rise after that excursion. We tried various expedients, such as taking a balloon down the western slope and releasing it there in the hope that it would rise above the mountain summit and continue upward. However, it was invariably carried almost horizontally across the summit and then down into the notch on the other side.

Planes avoided the mountain during my residence there. The notable exception was Arthur F. Merewether, then Air Force and now Chief of Weather Services, American Airlines, who paid us two visits on exceptionally calm days. He was then a student at MIT and had access to up-to-the-minute weather information which he used in planning his trips.

ALEXANDER A. McKEEZIE

Electronics Magazine
New York, N. Y.

Thanks for your most interesting letter, Mr. McKeezie. It's bound to be of great interest to pilots who frequent the skyways of the East. —ED.

Stall

Gentlemen:

In reference to the Dilbert article, "Will She Stall," and also Mr. R. E. Keough's letter in the May issue, in terms of physics if the wind were to stop suddenly, as stated, the plane could not gain enough kinetic energy in its mass to make it suddenly increase the groundspeed and thereby have above-stalling speed in relation to the wind. This only happens when the wind velocity decreases slowly and the plane is given ample time to gain inertia in its mass. The plane would have to dart forward the exact split second the wind stopped. Don't forget, the problem states that the wind stops instantaneously . . . which is an impossibility but such characteristics can be computed for. I say the plane definitely will stall.

H. M. SAINT

New Orleans, La.

Mr. Keough stated "If the 40-mph headwind stopped, it would only affect the groundspeed, not the IAS, and groundspeed does not affect stalling." A stall is the result of a loss of flying speed . . . and flying speed is any airspeed above stalling. Mr. Saint, we're inclined to go along with Mr. Keough and his contention that if the headwind stopped it would only affect groundspeed.—ED.

Corsair Question

Gentlemen:

In the March issue, page 20, there is a picture that's captioned "Crewmen service Panthers . . . etc." Some of the boys sitting around the ready-room here at Lockheed Flight Operations are wondering "wha' hoppen" to the tail and fuselage of the *Corsair* at the extreme right side of the picture. We can't find its rudder and can't figure out how the right side of the fuselage got messed up. One guess that was advanced by an ex-Navy jockey is that the plane was a strike and about to be pushed overboard. We also saw a phantom shape on the left top prop blade that we don't understand . . . we also noticed the right wheel has an unnatural slant to it.

TED LIMMER
BOB HANSON
E. HOLLIS
BEN KIRK JR.

Burbank, Calif.

We have you at a disadvantage, fellows . . . we can look at the original photo. From the "cut" in the magazine, it does look as though the Corsair *had lost its tail, etc. A close squint at the original, however, proves that's not the case. Actually, the* Corsair *is okay . . . all loaded and ready to go. The sun shining on the rudder of the plane completely blocks it out . . . and that phantom shape on the left top prop blade is, in reality, all that's discernible of the rudder. We don't know wha' hoppen to the right wheel. It looks slanted from here, too.*—ED.

Amateur Radio Operators

Gentlemen:

In the May issue you pointed out that one of the reasons Dilbert got into trouble was, in this instance, that he was accompanied by an amateur radio operator. This is a slur on almost a hundred thousand amateur radio operators in the U. S. There is no connection between an amateur radio operator and an unskilled radio operator.

L. C. HARLOW

N. Chicago, Ill.

Amateur radio operators are a very skilled group of people. They have to be to get a license to operate. In this instance, however, the source of trouble was not the radio, but rather that Dilbert had a radio operator establish his drift for him and then use the direction finder, two tasks with which this radioman was not familiar. I dare say a radioman would run into trouble if he were to ask a navigator to read and send code or to fix a radio. The trouble with Dilbert was that he blithfully accepted the information given him by a novice drift-sight user and direction-finder operator. Read the item again and I think you'll see the criticism was leveled at Dilbert; the radioman was an innocent victim of tools he wasn't familiar with.—ED.

B-36 and B-50 Engines

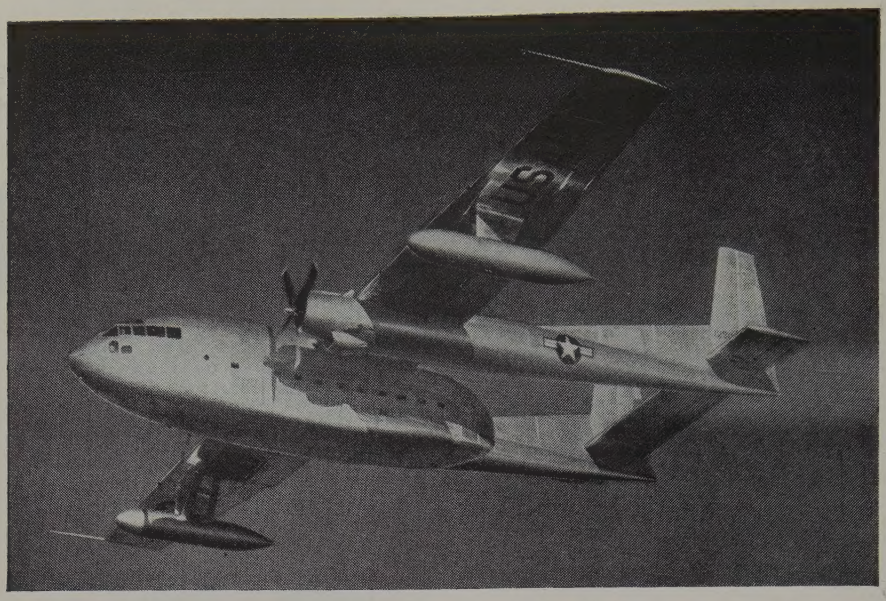
Gentlemen:

In your June issue you state the Boeing B-50 has four Pratt & Whitney R-4360 engines, and on the same page you say the B-36 has same type engines. How can that be when the B-36's are pushers?

B. MAJOR

San Francisco, Calif.

The B-36 has its R-4360-41 engines mounted pusher while the B-50's four Pratt & Whitney R-4360-35 engines are mounted in the conventional tractor manner.—ED.



FAIRCHILD C-119H features redesigned wing, rough-field landing gear, exterior fuel pods, greater payload and longer range. This photo was made during initial flight test

MILITARY AVIATION

Banshee

McDonnell Aircraft Corp. has delivered the last of the F2H-2 *Banshee* twin-jet fighters to the Navy. However, production continues on the F2H-2P photo reconnaissance version of the *Banshee*, and the larger F2H-3. Soon to go into production is the sweptwing F3H-1 *Demon* jet fighter for the Navy.

Research M-270

A radically new flying boat hull bottom, affixed to the wing and hull crown of a World War II vintage seaplane, is currently undergoing taxi and flight tests by Glenn L. Martin Co. on Chesapeake Bay near Baltimore. Designated as research model M-270, the hull embodies in full scale the results of years of extensive towing tank and wind tunnel tests. The M-270 is not a new airplane; only the lower portion of the hull is new. For years, flying boat engineers have envisioned longer, slimmer hulls to provide superior aerodynamic seaplane shapes as well as more efficient structural bodies, while retaining or improving the outstanding hydrodynamic characteristics of modern seaplanes. These shapes are dictated, too, through the necessity of having more efficient hulls in which to use jet engines to give seaplanes of the future greater speed. The M-270 consists of a wing originally built for the PBM *Mariner*, and the hull crown of the XP5M-1, with the afterbody lengthened six feet, and the nose cut so that it could be projected six feet further forward than on the XP5M-1. Because the M-270 is intended only as a test bed for the new hull design and is not required to fly for any considerable period of time, the fuel tanks in the hull have been eliminated and fuel is carried only in cells in the wing. The vertical and horizontal white lines on the M-270 are located in the same relative positions as similar lines painted on the towing tank model. Thus the engineers will be able to prove out hull lines in re verse, by making a full-scale check on th model, and show that the model tests wer accurate. The hydroflaps of the P5M-1 hav been incorporated into the M-270 hull.

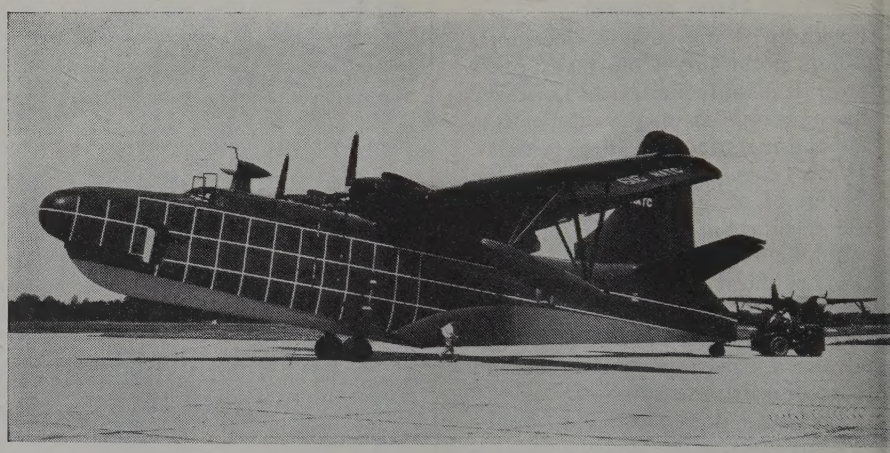
The M-270 hull is the result of years o work on the part of Martin engineers Though the aircraft began life as a PBM *Mariner*, then became the XP5M-1, and nov the M-270, it may have several other designa tions before its research usefulness ends

U.K. Answer to MiG

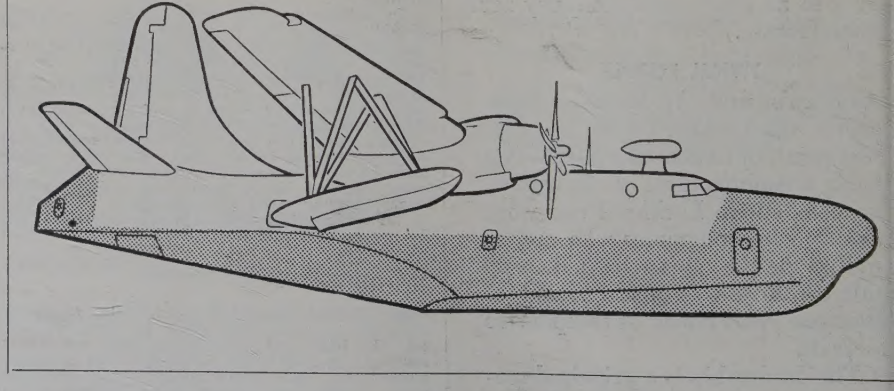
Britain claims to have an answer to th Russian MiG 15, and it is being given "supe priority" in the arms drive. It is the Hawke *Hunter*, a sweptwing interceptor powered b a Rolls Royce *Avon* jet engine. The *Hunter* i said to have demonstrated a sea-level spee approaching 700 mph.

Cooling Device

A cooling device so powerful that it ca change a searing blast of 600° air into snov within two-tenths of a second has been pro duced by a U. S. manufacturer. No large than a man's hand, this equipment was de vised to solve the cockpit cooling problem i high-speed aircraft. At the other extreme another manufacturer has designed a heate for aircraft engines operating in Arctic re gions. This heater can raise temperatur 345° in one second.



MARTIN MODEL M-270 is a test bed for a new hull design. White lines on M-270 are in same relative position as lines on towing tank model; are used to check tank test



DRAWING shows that part of the airplane (shaded portion) which was built onto wing and hull crown originally constructed for PBM *Mariner*. Nose is longer than on XP5M-

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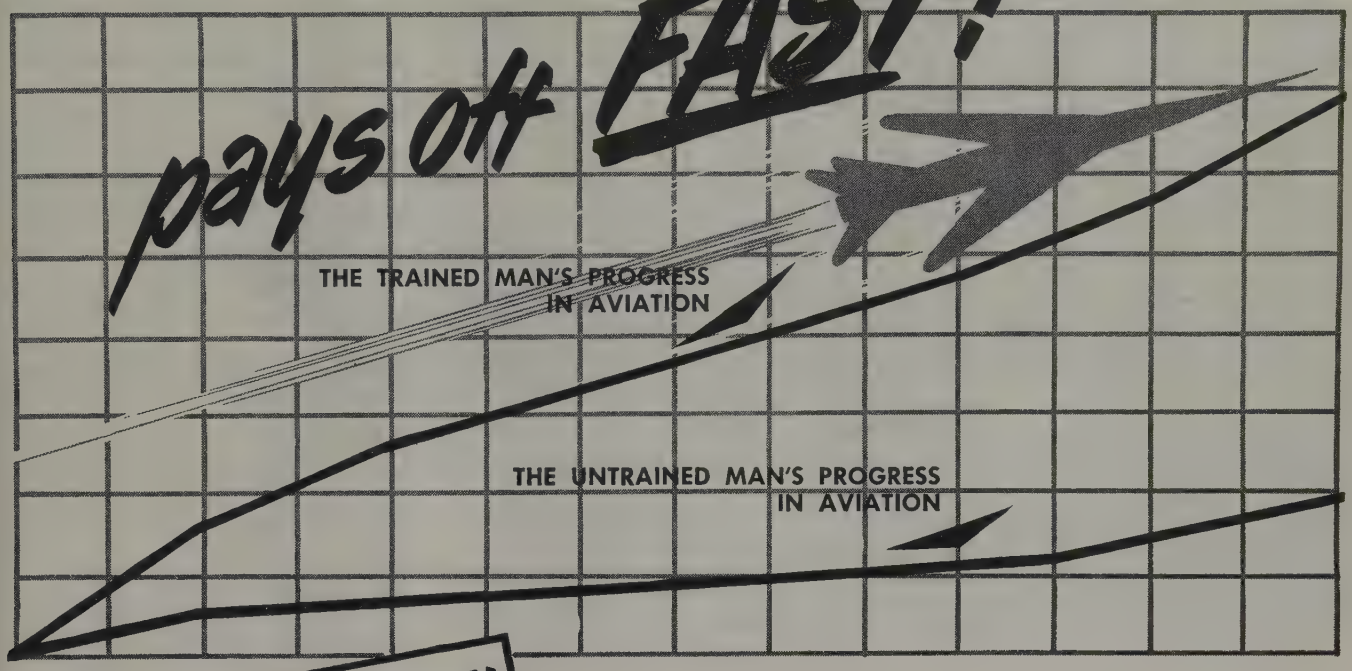

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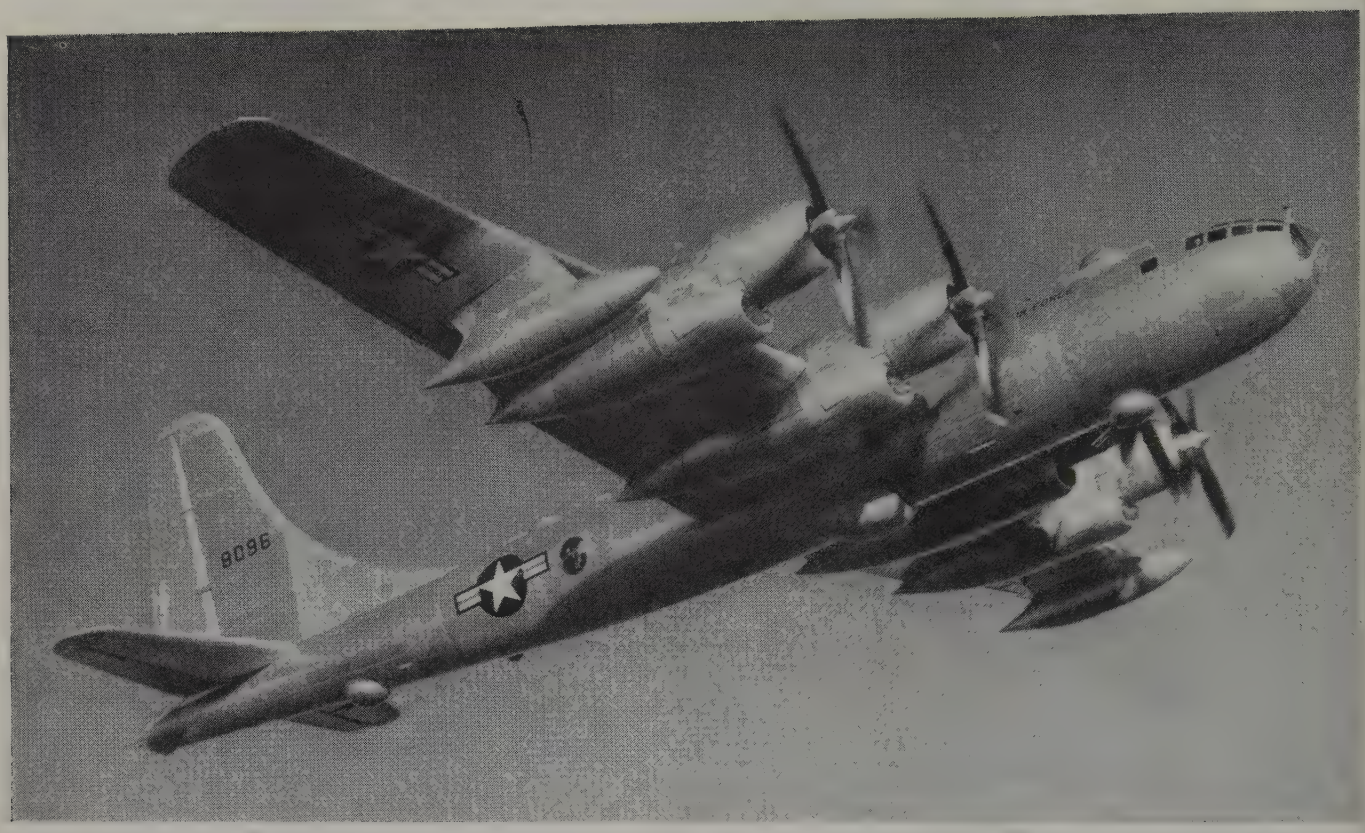


STRATEGIC AIR COMMAND, flying both piston and jet aircraft, has one of most enviable safety records in the AF

SAC Flies Operation Safety

By Capt. K. A. Eggensperger, USAF

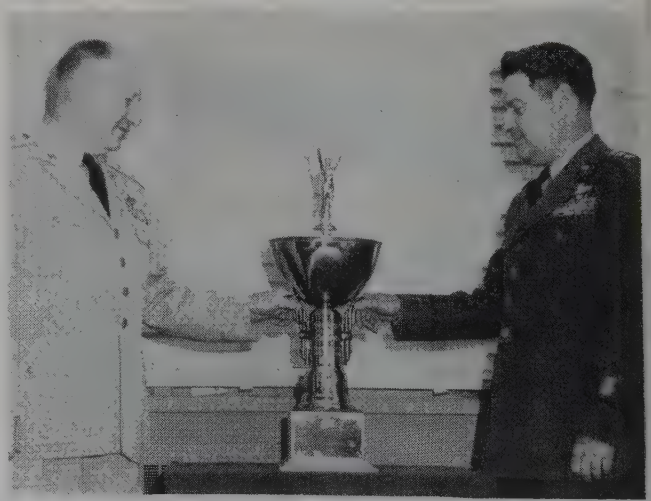
THE sleek RB-45 *Tornado* gracefully lifted itself off the runway at MacDill Air Force Base. As it gathered speed, the pilot, Lt. James H. McGrath, eased the jet's nose upward. In a matter of seconds, the *Tornado* was at 6,000 feet. There, with the suddenness of a pistol shot, No. 1 engine exploded and burst into flames.

Quickly, McGrath stop-cocked the throttle on No. 2 to prevent the fire from spreading. This resulted in loss of control of the RB-45 due to failure of the automatic and manual aileron hydraulic boost cut-out to function. The ship fell off into a steep spiral to the left, gulping precious altitude.

Both McGrath and his copilot exerted their full physical strength against the right aileron control to right the diving *Tornado,* but could not overpower the right aileron boost system. Analyzing the situation in a split-second decision, McGrath shut down No. 4 engine and ordered his two observers to bail out.

By now the heavily loaded *Tornado* was down to

SAFETY TROPHY, here admired by Maj. Gen. Irvine, Gen. LeMay *(right),* is awarded to base with best safety record



3,000 feet, out of control and with only one engine operating. Seconds later the windmilling effect of No. 4 subsided sufficiently to enable both pilots to stabilize the right aileron boost and gradually return the aircraft to level flight as the altimeter unwound to 1200 feet. McGrath nursed the plane out over Tampa Bay where he jettisoned his two wing tip tanks. Then, carefully, he aligned the descending plane with a nearby runway, lowered the gear by emergency means and brought the plane in safely for a no-flap landing.

Incidents—not accidents—such as Lt. McGrath's outstanding feat are becoming more common these days in the Strategic Air Command because of a vigorous and successful accident-prevention program.

The importance of an intensive flying safety program in SAC is better realized when one understands the command's mission. Officially stated, SAC has the task of "being prepared to conduct on a global basis strategic operations designed to effect the progressive destruction and disintegration of the enemy's war-making capacity to a point where he no longer retains the ability or will to wage war."

The emphasis SAC is placing on air safety is saving aircraft, tremendous amounts of tax dollars and most important of all, human lives. Another extremely important benefit, the true value of which is incalculable, is SAC's increased combat potential that results from fewer aircraft accidents.

Almost everywhere a SAC combat crewman pauses at a SAC base these days—the NCO or officers clubs, PX, operations, briefing rooms or on the flight line—he is constantly reminded by posters, bulletin boards, signs, spot radio announcements, newspaper stories and word of mouth to "fly safely." The reminders aren't the entire story of SAC's accident-prevention program by a long shot, but they are typical of the emphasis placed on safety in the United States Air Force's largest combat command. Despite the fact that versatile SAC crews operate the largest, fastest and most complex planes in the world—from jet fighters and the B-47 *Stratojet* bombers to combination jet and propeller-driven, 10-engine B-36's under the most strenuous conditions—it has an enviable safety record in the Air Force.

In the past two years its major accident rate has been cut almost in half—from a rate of 33 in 1949 to 24 in 1950, and 19 last year. In all but two months during 1951, SAC's monthly rate was below that of the corresponding period for the previous year. In addition, twice—in July and November 1951—new all-time record low rates were established in SAC.

The climax, thus far, to SAC's continuing efforts to reduce accidents came last February when the rate plummeted to a spectacular low of nine accidents per 100,000 hours of flying time. This was considerably below the over-all Air Force figure.

All this was accomplished during a period of aggressive expansion and training which doubled the number of flights, flying hours and assigned pilots during the year. Normally, such a marked increase in flight activities precipitates a higher accident rate. This easily could have been true of SAC had it not been for the increased emphasis on safety.

To SAC personnel the February record was a particularly outstanding achievement for two reasons. It, like the November record, was accomplished during one of the normally four worst accident months of the year—because of winter flying hazards—and it capped the first half of SAC's Flying Safety Year campaign, the command's most ambitious safety drive to date.

FLIGHT LINE signs, such as this one at entrance to flight line at Biggs AFB, reminds the SAC crews to fly safely

SAC CREWS work at safety. Proficiency of each SAC crew is checked twice annually in rigid standardization rides

Focal points of the Flying Safety Year, launched last September, are a handsome trophy and approximately $1,000 in cash awarded each month to SAC's safest base. During the campaign, the trophy is awarded monthly on a traveling basis. At the end of the Flying Safety Year it will be presented permanently to the safest base of the year. Funds for the monthly cash purse were raised in a Hobo Barrel drive by soliciting one dollar from each officer.

Monthly, each bomber base nominates an outstanding crew, and each fighter base an outstanding pilot from which SAC's Flying Safety Division selects a command-wide crew and pilot of the month for special recognition and honors.

Although the Flying Safety Year campaign has as its immediate objective making the 12 months ending August 31st this year the safest in SAC's history, its goal does not stop there. The safety habits its combat crewmen develop during the year-long competition will favorably affect SAC's accident prevention efforts long after the campaign ends and, regardless of what command its crewmen may serve in later years, they will remain safety conscious.

Selling any commodity as intangible as safety requires dozens of varying approaches, and all available methods are used at SAC stations. To kick off the Flying Safety Year, the first week in September was designated as Flying Safety Week. Most bases staged special dances, slogan contests and special accident prevention meetings to draw attention to the campaign.

A two-act home talent farce, entitled "Ahead of His ETA," in which the hero got an armful of white lilies and a lap full of cylinders instead of the girl, was produced at MacDill AFB to emphasize the campaign. At Travis AFB, Fairfield, California, the words "Fly Safely" have been painted in block letters with luminous paint on the sidewalks leading from base operations to the flight ramp. The same slogan is carried on the tip tanks installed on F-84's flown at Turner AFB, Albany, Georgia.

Spot announcements stressing accident prevention are broadcast several times daily by radio stations operated at Barksdale AFB, Shreveport, La. and Rapid City AFB, South Dakota. When tower operators at Ramey AFB, Puerto Rico, clear an aircraft for take off, they preface their clearance with the reminder, "Make this a safe flight."

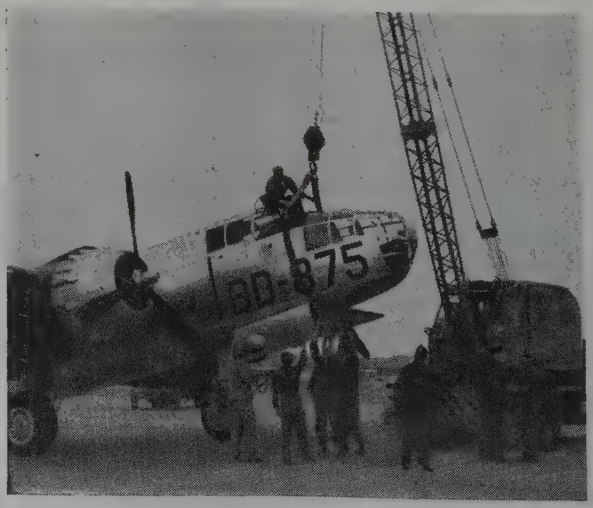
While it is still too early to assess accurately the full savings that will result from the Flying Safety Year campaign, they are certain to be large.

No one person is responsible for this remarkable savings of lives, material and dollars. The results are the aggregate of many factors: the intense personal interest and backing of the No. 1 man in SAC, Gene Nathan F. Twining, and his predecessor with SAC, Gen. Curtis E. LeMay; formulation and direction of the program by Maj. Gen. J. B. Montgomery, director of operations, and his young, exacting Flying Safety Division chief, Col. Frank W. Ellis; the execution of the program by the wing commanders and individual flying safety officers at base levels and, finally, the combat crews who fly SAC's bombers and fighters and the maintenance men who keep them flying.

So seriously did General LeMay, when he bossed SAC, view a major accident and its crippling effects on SAC's combat capability that he required the commander of the wing involved to report to him in person. That order still goes, now to Gen. Twining. This accomplishes two things: it provides him with a detailed first-hand account of an accident, its causes, where the responsibility lies and the corrective action being taken; and indelibly impresses upon the wing commander the vital importance attached to saving air crews, planes and tax dollars. It also serves to put the wing commanders directly into the flying safety business, because the reporting procedure is no mere routine. Certainly it's a visit to headquarters every wing C.O. would prefer to skip. They must know every detail of the accident in order to discuss intelligently with the General the known or possible cause factors and what can be done to prevent future accidents of that type. The SAC Commander is firm in his conviction that, "You can learn something from every accident that will help prevent the next." His wing commanders, most of whom have contributed to the diminishing accident rate in SAC, unanimously share this conviction.

Thus, SAC's Flying program enjoys unqualified support from commanders without which it would not enjoy the success it does. The core of the program, however, is sound, (*Continued on page 39*)

MAINTENANCE crew at Carswell tow B-25 off runway. B-25 was landed safely despite unusable, dangling nose gear



VIHURI fighter trainer is a tandem two-seater powered by 830-hp Bristol engine. It has top speed of 273 mph, and has cruising speed of 217 mph. *Vihuri* is now completing acceptance trials in Finland

Air Role of FINLAND

By Bill Black

Scandinavia, although a *minor* land bloc on the northern fringes of Europe, is of *major* importance in today's air strategy. Forming the only sub-Arctic region fully developed from the economic and transport viewpoints, the Scandinavian countries are unquestionably playing an important role in Soviet advance planning: during World War II, Norway was not occupied by the Germans solely on account of her ice-free ports, nor was Denmark occupied merely to make sure of its agricultural products—their strategically situated air bases were considered essential for the successful operation of the war against Britain.

How much *more* important will Scandinavian air bases be in any future conflict: Soviet bomber formations using the Arctic route to attack North American industrial centers would be largely dependent on a ground organization in Northern Europe. Conversely, Soviet occupation of Scandinavia would deny the use of vital bomber bases to the Western powers and would render increasingly difficult the task of the USAF in attacking Russian plants in the Ural areas. Russia already has a foot in Scandinavia: Finland, and she has now begun to put the squeeze on the other members of the Scandinavian family of nations, for this area is of vital importance to the Kremlin. And Scandinavia, which yesterday stood in the shadow of world events, has today emerged in the forefront of the international picture.

Of the Scandinavian (*Continued on page 41*)

PROTOTYPE fighter developed in 1946 was *Pyorremyrsky (Whirlwind)*, powered by 1,475-hp Daimler-Benz engine

STANDARD Finish fighter was the *Myrsky (Wind)* forerunner of the *Whirlwind*. Sixty-one were built in 1944

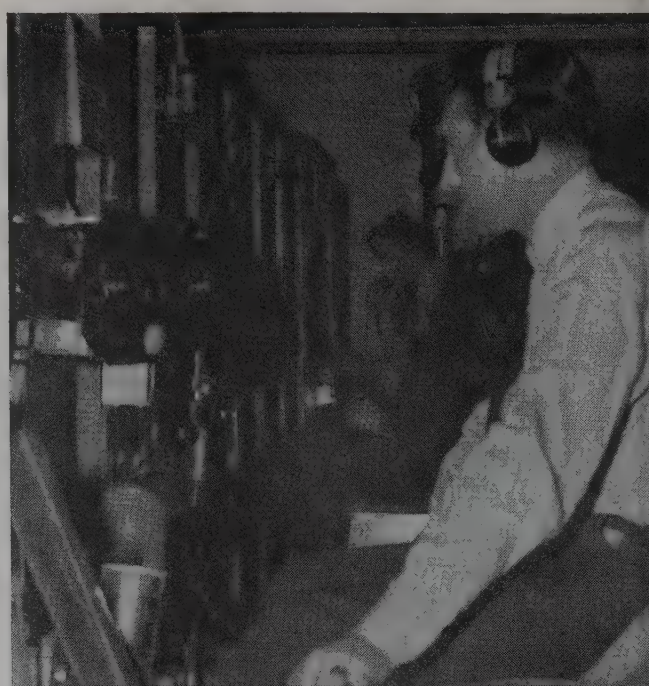
EKLUND TE-1 is a small amphibian originally powered by 28-hp Poinsard engine. It now employs 40-hp Continental

AIR FORCE flying personnel are required to take aviation physiology training which includes "flight" in an altitude training chamber. Here, S/Sgt. Simmons *(center)* demonstrates the use of a "walk around" oxygen bottle

ARMED FOR ALTITUDE

TEST for a leaking mask is a swab of cotton soaked in oil of wintergreen. If mask leaks, odor would get through

OPERATOR of the chamber mans the controls during an "ascent." Note altimeter, rate-of-climb on the panel



Air Force hits back at hypoxia by teaching recognition of symptoms

By M/Sgt. Don Weber, USAF

I leaned back in my seat. The altimeter indicated 35,000 feet. I had a distinct feeling of well-being. Things were rosy and the world was a good place to be in. I was a little drowsy but otherwise felt perfectly normal. Somewhere in the distance a voice was trying to break into my reverie. Something about connecting my mask. To hell with him—if he wanted that mask connected, let him connect it himself. Things suited me fine just the way they were. This was living!

There was only one thing wrong with this situation. If something wasn't done, in less than four minutes I would be dead!

I was suffering from hypoxia—if you can call that feeling of extreme well-being suffering, a condition where there is a partial lack of oxygenation of the blood.

It was fortunte that I was in the decompression chamber at Wiesbaden Air Base in Germany, instead of alone in a plane 35,000 feet above it. It was also fortunate that this potentially dangerous condition in which I found myself was a part of the training being given by the Aviation Physiology Training Section of the 12th Air Force—training that would enable me to recognize the symptoms of hypoxia immediately.

The necessity for this sort of training became evident during World War II when planes first began flying and fighting in the rarified atmosphere above 20,000 feet. During those days of the war, some lives among air crews were lost unnecessarily because of too little knowledge of the symptoms of hypoxia and other forms of decompression sickness.

Since then, all USAF flying personnel are required to take aviation physiology training and a refresher course which includes a high-altitude "flight" in an altitude training chamber.

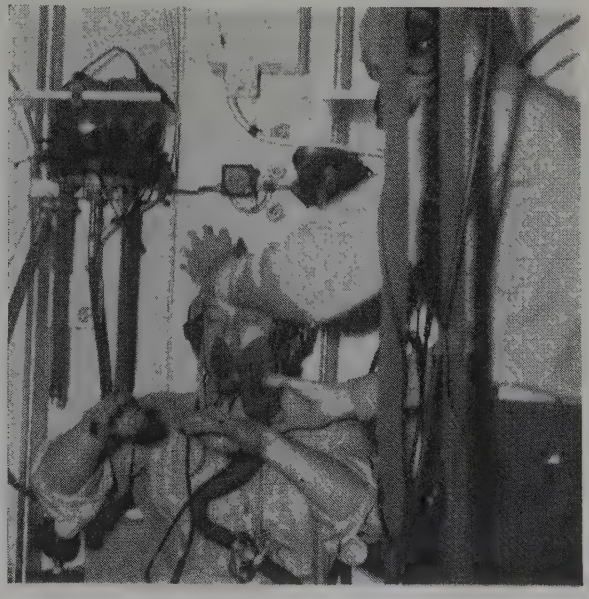
With the construction of the chamber in Wiesbaden, the only one of its kind on European soil, this training has become available to flying personnel of all the NATO nations. Already several Dutch flight surgeons have completed the course.

Although comparatively short, the course is considered adequate to acquaint flyers with the dangers of high-altitude flying and to teach them recognition of the early symptoms of hypoxia. It combines four hours of classroom instruction with practical demonstrations in the altitude chamber.

The chamber resembles a huge oblong steel safe. It is 23 feet long, eight feet wide, seven feet high on the inside and weighs more than 80,000 pounds. Its walls of ribbed steel can withstand an inward pressure equivalent to an altitude of more than 100,000 feet above sea (*Continued on page 44*)

MASK off at 35,000 feet, student tries to demonstrate flying maneuvers. He simulated a bank, then blacked out

STUDENT after less than a minute without oxygen at 35,000 feet is on verge on unconsciousness, can't move hands

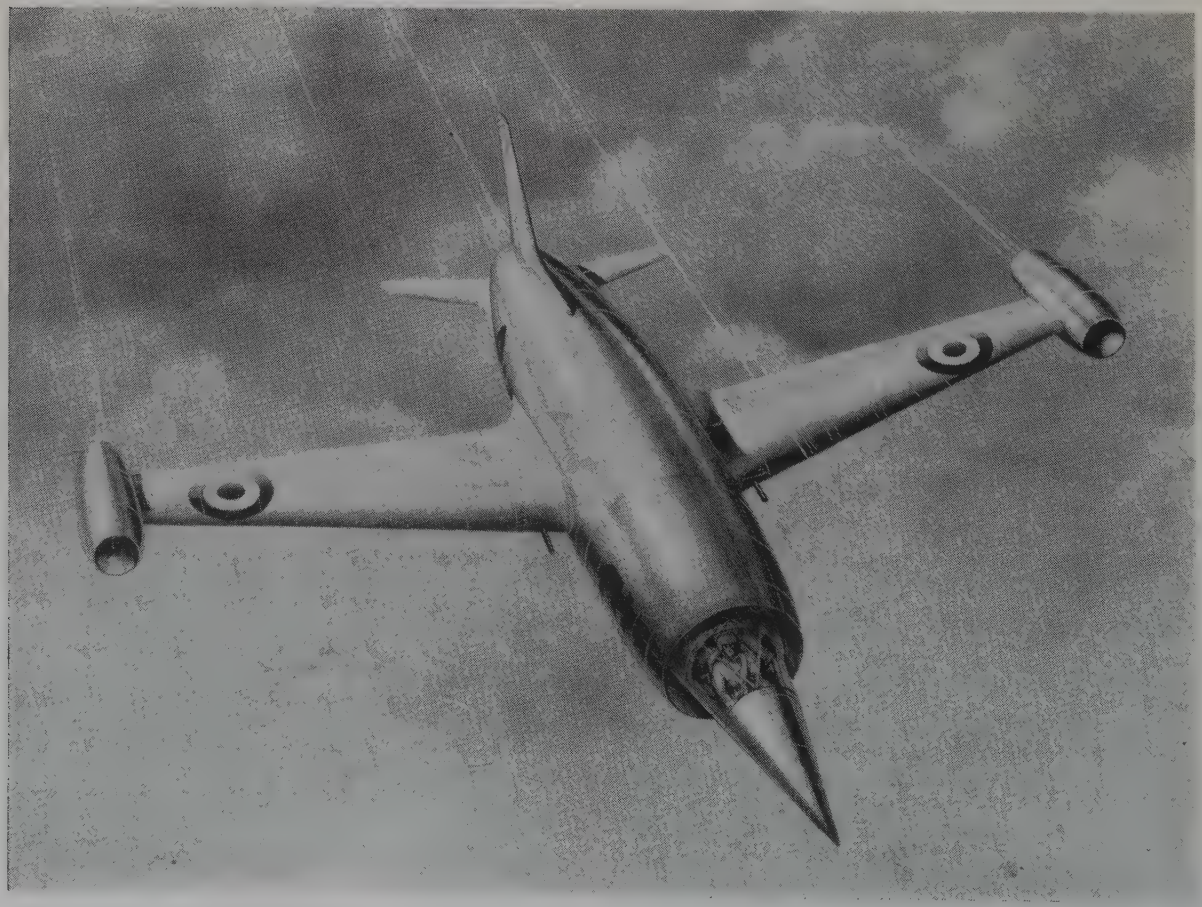


Ramjet Interceptor

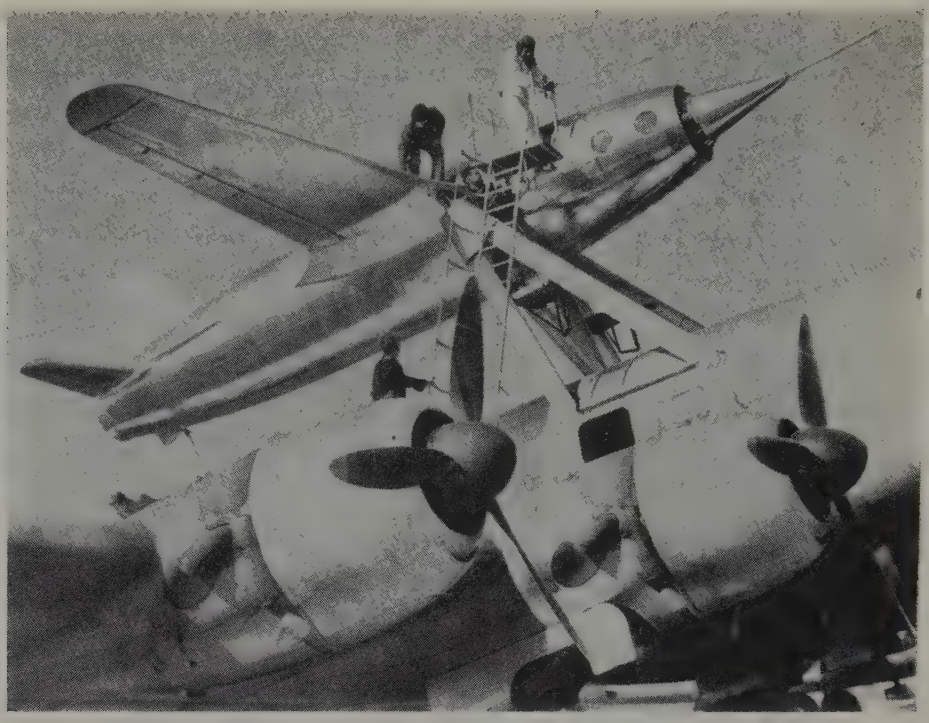
By William Green

A little under four years ago it was revealed that the world's first man-carrying ramjet plane had flown under its own power in France. Known as the Leduc-010 and designed by ramjet-pioneer Rene Leduc, this revolutionary research airplane presaged things to come in supersonic aviation. Although the French have displayed a natural reluc-

LEDUC-021, expected to make its first flight in early Fall, will be first ramjet fighter. Developed in France by Rene Leduc, it is a single-seater. Turbomeca *Marbore* II units, 840 pounds thrust each, are mounted on wingtips. Combined power is sufficient to lift Leduc-021 off ground and attain airspeed at which ramjet can be lighted



PILOT of Leduc 010, prototype 021, is Mons. Gonord



LEDUC-010 was flown from parent ship in 1947 to test aerodynamic characteristics

tance to make available the results of data amassed since the Leduc-010 first screamed through the air under its own power, we can reveal that Monsieur Leduc's two decades of research have resulted in a startling combat airplane; a fast-climbing, short-duration, "target-defense" interceptor, employing a ramjet as its prime mover and small wingtip turbojets for take-off and landing.

Known as the Leduc-021 and now being readied for flight testing at the Quai de la Seine plant at Argenteuil, this revolutionary combat airplane is looked upon by the French as the future defensive weapon against supersonic bombers, and there is much evidence to support their views. While ramjets are unlikely to be the panacea for all combat airplanes, as has at times been predicted, there can be little doubt that the ramjet fighter will play a leading role in the next stage in air defense, for it is inevitable that the sequel to today's turbojet-afterburner driven fighters will be similarly powered bombers with Mach numbers between one and two, and operational altitudes above 60,000 feet. The vast majority of interceptors presently under development will be powerless to prevent their attacks.

Today, jet fighters have only roughly the same speed and ceiling as their new bomber opponents and, taking something like 10 minutes to climb to combat altitude, can no longer offer effective opposition to the high-altitude bomber. Thus, the turbojet fighter is already technically outdated, although its life will undoubtedly be prolonged by the application of afterburning. In the lower supersonic range, this turbojet-afterburner combination has a higher thrust in relation to its frontal area than the pure turbojet or pure ramjet, and its efficiency falls somewhere between these two basic types, but its disadvantages include structural complexity, weight and cost.

Bombers now under development with turbojet-afterburner combination powerplants will catch up on the similarly powered fighter's speed advantage only too soon and, according to Rene Leduc, the answer for the immediate future is the ramjet, defense rockets only beginning to compete when the density of the atmosphere (*Continued on page 51*)

RAMJET PIONEER and designer of the Leduc-010 and 021 is Rene Leduc. He began ramjet work in France in 1933

RADIO offers pilot weather information, navigation help and whole host of in-flight aids. A mike button *(below)* will put out your code communication in an emergency. CW should not be neglected topic

Radio Aid to XC

By Wesley Neal

Probably more than any other aid to flying, the radio can do the most to help the private pilot in his trips through the blue. Radio is, in a very real sense, the pilot's "right-hand man." Here are a few suggestions for capitalizing on your aircraft radio's usefulness.

An elementary use of radio is the matter of requesting traffic-pattern instructions at a strange airport. Failure to do this can raise your blood pressure or lower your life expectancy. For instance—

Assigned as instructor to an area where several tower-controlled fields were used for student flying, I approached one of the auxiliary strips one day without bothering to ask for traffic directions. Up to this time, all the fields had flown a right-hand pattern. And—erroneously—I assumed the general rule to be still in effect. Wrongo bongo! On my base leg, imagine my surprise to find myself staring down another pilot's air scoop. Temporarily, traffic had been changed to left-hand and I was odd man on the stick. Ask that man in the green glass cage for instructions. It's safer that way. And besides, it's the law.

Here's a simple radio tip which, perhaps, goes by the board more often than any rule in flying: weather information.

To provide weather facts for cross-country pilots, the CAA makes standard weather reports on all voice-equipped communications stations at 15 and 45 minutes past the hour.

Sometimes, however, when tricky weather sets in over rough terrain, a pilot needs information *now.* The 15-45 minute after-the-hour broadcast is for convenience, but any pilot, needing a report at a time other than these set periods may call the CAA for help. Just last week, one Southern California boy crashed into a mountain when he ran into some marginal weather between Los Angeles and San Diego. One short exchange with the nearest Communicator would have provided him with the facts that VFR over those mountains was out of the question.

Your radio may come in handy, too, if you wish to alter your flight plan enroute. Two private flyers whose ETA had gone haywire late one afternoon decided that their original destination was beyond the remaining sunlight, so they decided to set down at an intermediate field. Airborne, these lads could have easily contacted a CAA station. But they neglected to do so, assuming that they could close their flight plan by telephone when they landed.

Unfortunately, the little-used field where they stopped had no telephone facilities. And on the ground, near-by mountains blanketed out their radio. Consequently, a full-scale search operation was put under way on their behalf when their destination failed to receive word of their unintended landing. Use that radio to change, modify or cor-

rect your flight plan data while still in the air. All around, this procedure makes for better results.

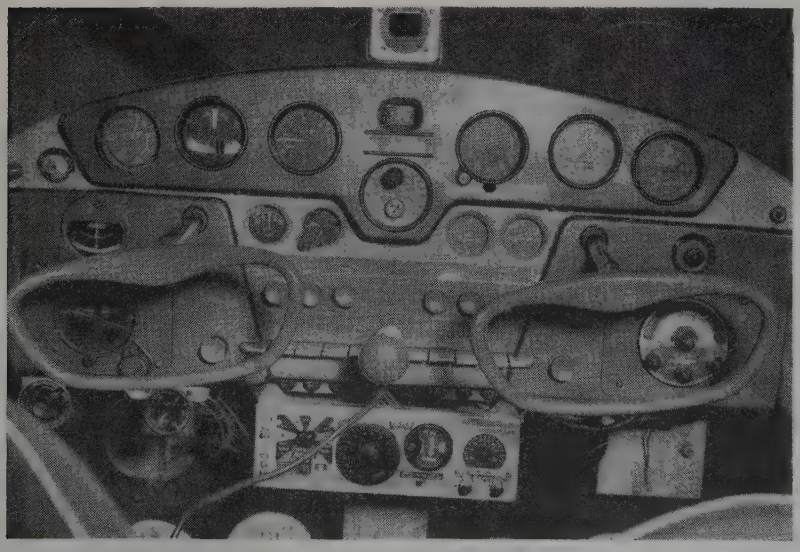
Every airplane should carry, as standard equipment, a sunrise and sunset chart. But when this is not the case, again the radio helps fill the bill. Our friends above might have avoided an expensive and embarrassing experience had they taken the trouble to call for sunset time. Even more serious was the example of the West Coast flyer who failed to call on his "right-hand man" for help.

This pilot was navigating through some mountainous terrain on one of his first cross-country flights. Here, too, his time of arrival was off and that old sun began to sink behind the hills. Because of his inexperience, this lad overlooked two facts with which every pilot should be familiar: 1) daylight lingers at altitude when the long shadows have already begun to stretch on the ground below, and 2) this situation is aggravated by high mountain peaks. As a result, night was beginning to set in at our friend's destination. Only he didn't know it.

Along this boy's course were several fine auxiliary fields where he could have landed while there was sufficient light. Had he radioed ahead to learn sunset time at his point of intended landing, he would have realized that a premature touchdown was his best bet. Instead, our boy blundered along until he had to make a night landing—a requirement for which he was totally unprepared. Result: one washed-out airplane and one hospitalized aviator.

Other unusual conditions at your destination which may influence your decision to choose an alternate landing site, too, can be anticipated by means of radio. In actual practice, many pilots monitor radio navigational aids along the route of their flight. Some flyers, however, upon approaching their proposed landing field, tune to tower frequency. Limited as may be the range of tower broadcasts, this practice is not without its advantages. One night I was flying east toward El Paso, chasing ahead of a front which had been closing in fields behind me ever since I left the coast. My ship was not fully equipped for instrument flight and I had no desire to be caught up in the weather. Consequently, I hoped to enter the traffic pattern with a minimum of delay and get on the ground.

Some distance west of El Paso, I turned to tower frequency and heard one side of a two-way conversation between the tower operator and the pilot of a B-24 with a jammed-up landing gear which was circling above the (*Continued on page 55*)

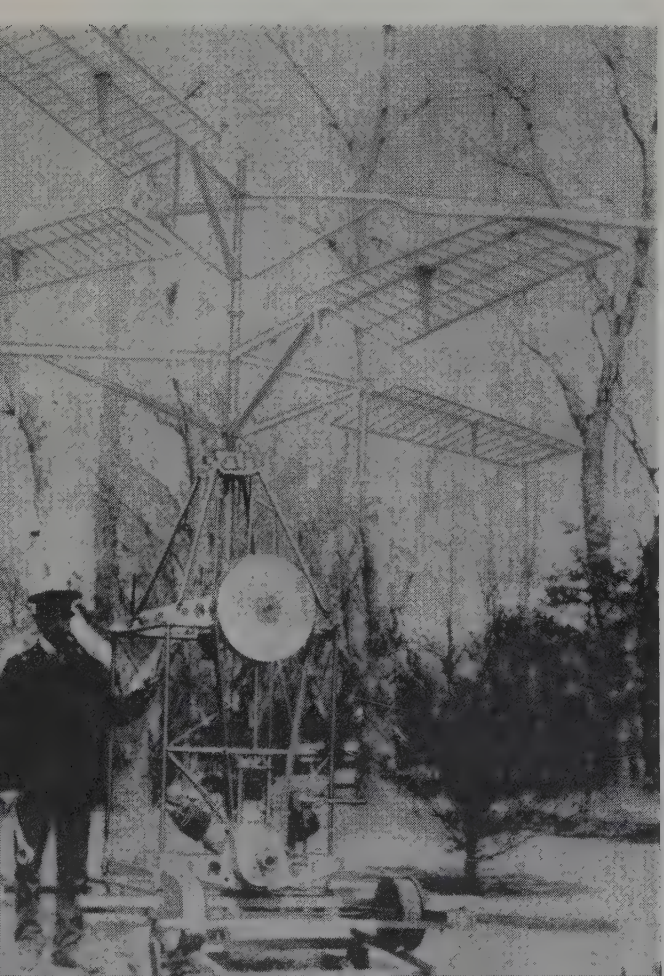


NAVIGATION is made easier by VHF Omnirange, the most advanced of all radio navigational aids available to private pilots. Meter *(above)* is Narco "Left-Right"

RADIO INSTALLATION as complete as this one in Cessna makes a pilot's job easier. Radio navigational aids are not for use of qualified instrument pilots only

SIKORSKY...master of the

THEN AND NOW—The S-55 *(above)* is one of Igor Sikorsky's latest helicopter designs. One of his first designs was this strange looking helicopter *(below)* built by Mr. Sikorsky in his youth in Russia back about 1910



Today's helicopter is the result of a schoolboy's dream 50 years ago

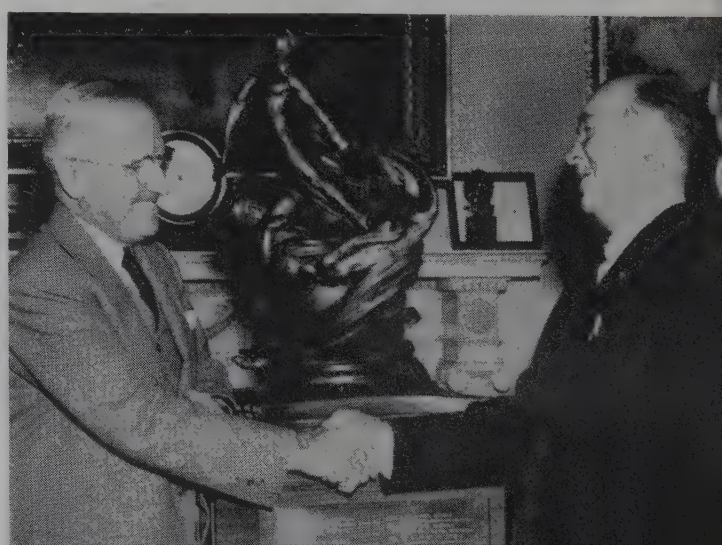
By Harland Manchester

It has been established by competent authorities that human flight is impossible. Not even Nature can put a bird in the air weighing over 30 pounds."

A well-mannered boy of 12, Igor Sikorsky thanked his elders for their advice and returned to his room to resume work on a model of a strange craft which he hoped would rise directly from the ground by means of an overhead propeller. He had built several models, whittling out his propellers and using a twisted rubber band for power. None of them would fly. But at last he licked the gremlins, and the little ship whirred upward and smacked the ceiling. His father's scientific friends agreed that he had an amusing toy.

Today, Igor Sikorsky's 50-year campaign to perfect the helicopter has refuted generations of scoffers. Other inventors, inspired by his example, have also produced successful "flying windmills." The ship that couldn't be built has become as handy as a wheelbarrow for a hundred workaday jobs. has saved lives by the thousands, and is inevitably headed for new horizons in short-haul transporta-

COLLIER TROPHY—On behalf of helicopter industry Mr. Sikorsky received Collier Trophy (1951) from Pres. Truman



impossible

tion. Last year in recognition of the helicopter's service in flying out the wounded in Korea, the Collier Trophy—presented annually for "the outstanding contribution to American aviation"—was awarded to the helicopter manufacturers of the United States. Igor Sikorsky, as Grand Old Man of the Industry, was chosen to receive the trophy from President Truman.

Sikorsky was steeped in science when very young. His father, an eminent professor of psychology in Kiev, Russia, talked to him about electricity, astronomy and physics. As a boy Igor built several batteries, a small electric motor and a steam-powered motorcycle. One day his mother, a medical-school graduate before marriage, told him about Leonardo da Vinci and showed him da Vinci's sketch of a proposed helicopter. From that day to this the helicopter has been his meat and drink, although for 28 years he shelved his great ambition in order to pioneer in the design of giant fixed-wing planes.

In the summer of 1908, Igor, then 18, read for the first time an accurate account of the first flight of the Wright brothers five years before. The story set his blood tingling. He built a four-foot propeller and, using a weight and pulley to spin it, tested its lifting power. He concluded that a practical helicopter was possible.

Now he dreamed of going to Paris, the world's aviation capital, to talk with flyers, study their machines, and buy an engine and propeller materials. But he had no money of his own, and only one person took his dream seriously—his older sister Olga, a schoolteacher. "I have saved up 3,000 rubles (about $1500)," Olga said. "Go to Paris."

In Paris, Igor enrolled at a flying school which met in a hangar and had no examinations, diplomas or textbooks. After a few months he knew the little others knew, and "graduated."

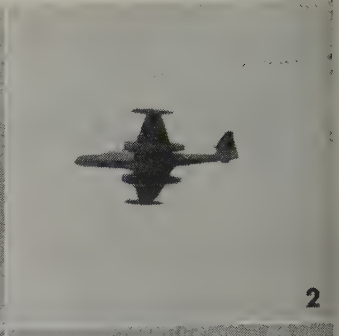
"Don't waste your time on a helicopter—it's hopeless," his teacher told him when he said goodbye. So Sikorsky bought a 25-hp motor and some parts and returned to Kiev to build a helicopter.

In the summer of 1909 he assembled his first ungainly craft. It had two lifting propellers mounted on the same vertical axle and rotating in opposite directions. When, in a test, it tried to turn over and nearly wrecked itself, Sikorsky was very happy. "It seemed to me the craft was trying to go into the air. He dismantled the ship, however, and eagerly drew up plans for a new one.

His father, impressed with his son's persistence, staked the budding inventor to another trip to Paris to buy two more engines. The second helicopter, completed the following spring, almost lifted its own weight of 400 pounds. Igor knew now that more power and differently designed propellers would do the trick. But he had worked for a year and a half and had spent a large sum of family money with no tangible results. Reluctantly, he shelved his flying windmill and began a new career, at the advanced age of 21. He turned to small and less complicated biplanes.

During the next two years, Sikorsky built four planes out of "spit and string," escaped miraculously from numerous crashes. With complete confidence and no reproaches, his father put a second mortgage on the house and told Igor to keep at it. The local plumber made the radiators for Igor's planes, a bicycle repair shop turned out the undercarriages, schoolmates from the polytechnic institute helped for nothing. The fifth effort, the "S-5", justified everyone's (*Continued on page 52*)

SIKORSKY AMPHIBIAN—This 10-place twin-engine amphibian, designed and built by Mr. Sikorsky and designated S-38, pioneered long-distance mail and passenger service throughout Western Hemisphere; over 100 were built

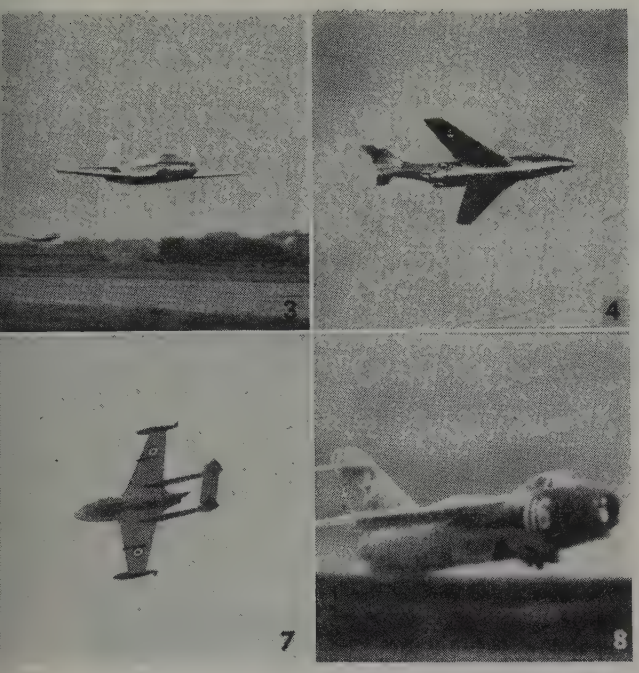


AIRCRAFT

Should an open clash develop between Russia and the Western World, the ability to differentiate between the four single-engined, sweptwing fighters featured on these pages will be of top importance. Two of this month's quartette, the F-86E *Sabre* and the MiG-15, have already met in combat over Korea, and are facing each other in Europe; the MD 452 *Mystere* is about to enter production for French elements of the NATO air defense, and the Lavochkin fighter—unofficially designated La-17 is known to share the fighter defense of the Soviet Union with the MiG.

All four have a number of features in common; all employ simple but highly efficient nose intakes and feature the fashionable wing leading edge sweep angles between 30° and 37°. It is, therefore, of

SILHOUETTES show configuration of the USAF F-86E *Sabre (above, left)*, the Russian MiG-15 (bottom, left), the French Dassault Md 452 *Mystere (above right, opposite page)* and the Russian Lavochkin La-17 fighter *(bottom right, opposite page)*

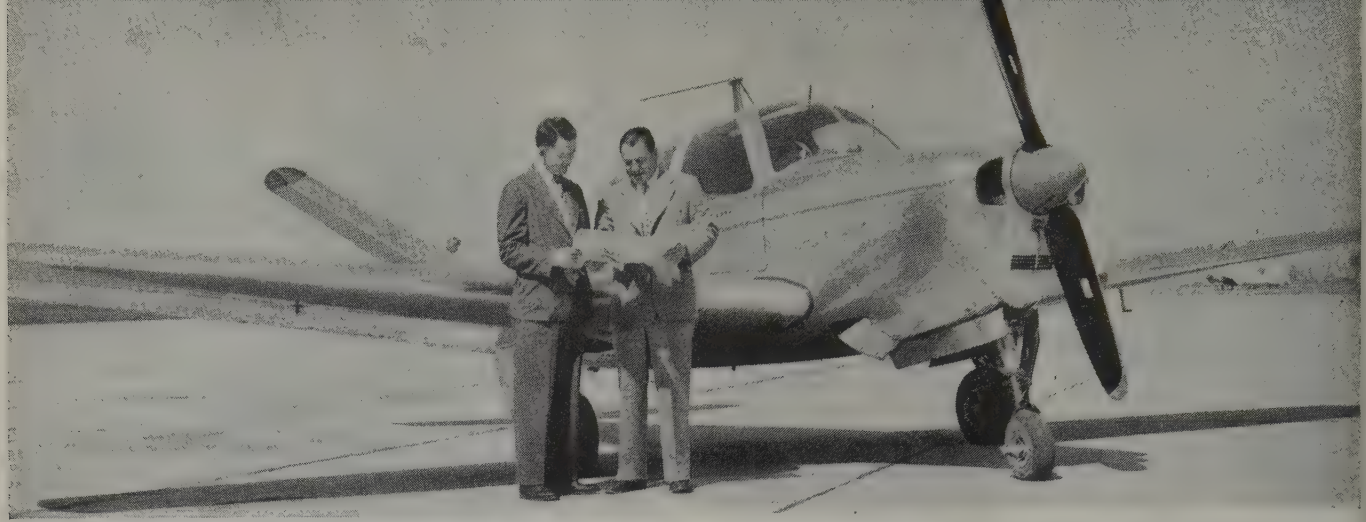


dentification

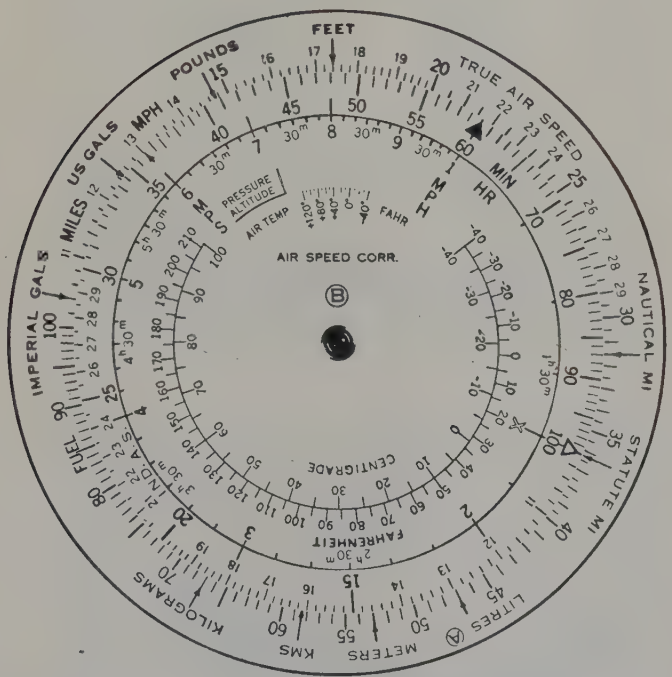
particular importance that the detail design differences between each airplane should be carefully noted.

The North American F-86E *Sabre* is undoubtedly the most aesthetically appealing of the four airplanes. In the air the *Sabre* has a more rakish sit and slimmer contours than its contemporaries, and viewed from below, its wing, with its 35° sweep angle, appears small in proportion to its fuselage. The wing has marked leading-edge taper and blunt, almost square-cut tips. The fuselage of the F-86E *Sabre*, unlike that of the French or Russian fighters, is of oval section, and the circular air intake is lipped above to maintain adequate airflow in nose-up position. The all-round vision cockpit hood is mounted over the leading edge of the low-set (*Continued on page 49*)

IN-FLIGHT ID photos *(above)* are (1) F-86A *Sabre*, (2) British *Meteor* NF. 11, (3) F-80 *Shooting Star*, (4) F-88 *Voodoo*, (5) MiG-15, (6) F-84E *Thunderbolt*, (7) the British *Sea Venom* NF. 20, and (8) the Russian Lavochkin La-17



FLYING VFR, the private pilot can still use the familiar statute mile for navigation and any other speed and distance measurements or computations. Aeronautical charts already show both statute and nautical-mile scales

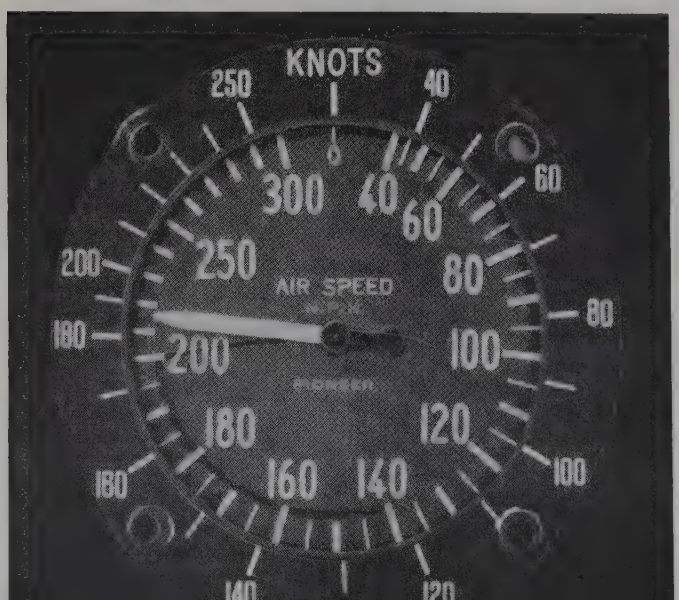


COMPUTER shows equivalent value for statute and nautical miles, in this case 100 statute equal 87 nautical

Pilot Approach to Nautical Miles

By F. B. Lee

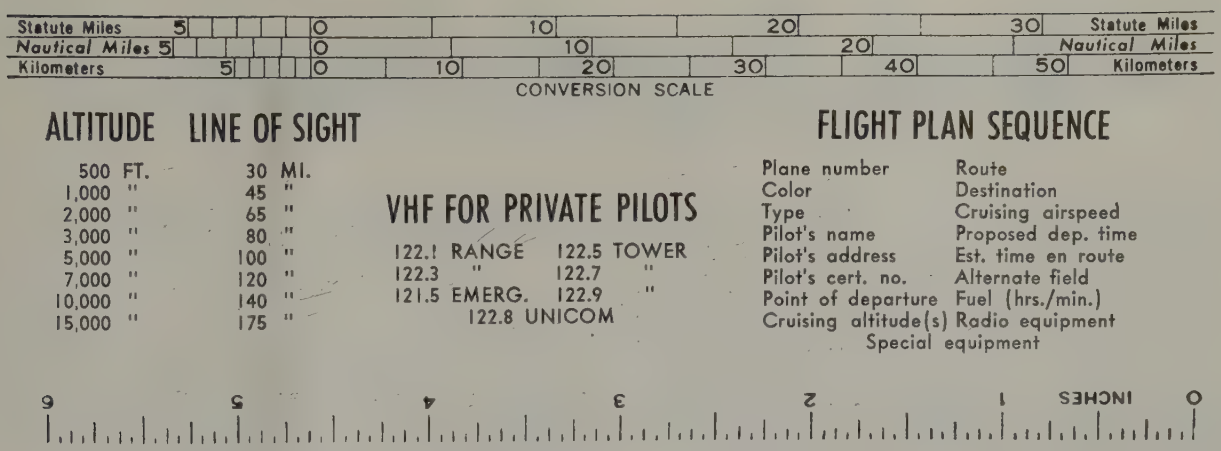
Deputy Administrator of Civil Aeronautics



PLASTIC RING is shown here attached to existing airspeed indicator so that airspeed can be read in mph or knots

If you have had occasion to get the speed of winds aloft anytime in the last three and one-half years, you received it in knots, *i.e.*, nautical miles per hour.

Perhaps the first time you heard the wind speed given in knots, it seemed a trifle strange. You might have been used to it if you were a Navy flyer, or if you had flown post-1946 Air Force types, or if you had been flying on international runs of the airlines. Otherwise, you had to go through a brief period of adjustment. By now, however, you take


Statute Miles 5 0 10 20 30 Statute Miles
Nautical Miles 5 0 10 20 Nautical Miles
Kilometers 5 0 10 20 30 40 50 Kilometers
CONVERSION SCALE
ALTITUDE LINE OF SIGHT
500 FT. 30 MI.
1,000 " 45 "
2,000 " 65 "
3,000 " 80 "
5,000 " 100 "
7,000 " 120 "
10,000 " 140 "
15,000 " 175 "
VHF FOR PRIVATE PILOTS
122.1 RANGE 122.5 TOWER
122.3 " 122.7 "
121.5 EMERG. 122.9 "
122.8 UNICOM
FLIGHT PLAN SEQUENCE
Plane number Route
Color Destination
Type Cruising airspeed
Pilot's name Proposed dep. time
Pilot's address Est. time en route
Pilot's cert. no. Alternate field
Point of departure Fuel (hrs./min.)
Cruising altitude(s) Radio equipment
Special equipment
INCHES 0 1 2 3 4 5 6

CONVERSION SCALES for use in obtaining nautical mile equivalents are available. This one, developed by private pilots association, also lists VHF frequencies for pilots, line-of-sight distances, flight plan sequence

it as routine to hear winds aloft reported in knots.

The use of knots and nautical miles was extended to other CAA and Weather Bureau transmissions on July 1, 1952, and pilots should find the change just as painless as was the 1949 shift to knots for winds aloft. The average private pilot will scarcely notice the change. Flying locally or even making cross-country trips in VFR weather, he can use the familiar statute mile for navigation and any other speed and distance measurements and computations. If he finds it necessary to get information from CAA or Weather Bureau personnel that they ordinarily would provide in nautical miles, he can say, "Please give me that reading in statute miles," and they will. It's as simple as that.

But suppose you are an executive pilot (a category in which I like to consider myself when I get an opportunity to fly my own plane or CAA aircraft on official business). As an executive pilot, you do instrument flying. Navigation, therefore, is no mystery to you.

You are used to working with aeronautical charts and you know that the local, sectional and world aeronautical charts already show both statute and nautical-mile scales, so that it is easy to plot your flights on a nautical-mile basis. To attain uniformity, the radio facility (RF) and approach and landing (AL) charts will be published with nautical miles added to their present values. In addition, the Airman's Guide and Flight Information Manual will contain simple conversion tables.

When you file your flight plan, proposed speed should be stated in knots. If for any reason you find it impossible to do this, the CAA communicator at the Flight Assistance counter will convert your statute-mile figure for you.

In the air, you will follow through your flight plan entirely on a nautical-mile basis, without having to stop and think about conversion. To make this possible, an inexpensive plastic ring is being developed to go around the face of the existing airspeed indicators. This ring will read in knots, so that at a glance the pilot can see his speed in either knots or statute miles.

For rapid conversion of other figures, a table in the form of a "decal" is being prepared. This can be pasted permanently on the dash or elsewhere in the cockpit.

Why has the United States government adopted the nautical mile as the standard unit of measurement? The basic reason can be stated simply—to make possible safe and efficient operation of a single airways system for both civil and military use. The need for such a system becomes more urgent as each year brings another increase in air traffic, but we can trace the problem back to 1942.

That year is significant as the beginning of a vast expansion of transport (*Continued on page 48*)

Attention: All Pilots!

As SKYWAYS went to press, the CAB voted 3 to 2 against the change-over from miles per hour to knots. As a result, a great state of confusion exists. The Air Coordinating Committee already had agreed to the ICAO recommendation for the change. The nation's air carriers already have made extensive expenditures in readying instruments, etc., for knots instead of mph. According to report, the airlines plan to continue in the direction of the change. Lawyers presently are in a huddle to see where "right" lies. A final decision may be a long time coming. In the meantime, SKYWAYS brings to its readers the comments and opinions of CAA Deputy Administrator F. B. Lee, in full knowledge that "change" is the one thing we can be sure of . . . and it's just possible that knots, ACC and ICAO will eventually win out.

—Editor

Hourly Sequence Reports

By Keith L. Gimson

First Officer, Delta Air Lines

Your first thought before taking a cross-country flight probably is, what is the weather? Until quite recently it was very difficult to tell from the hourly sequence reports just exactly what the local weather was at any given station. You could tell the height of the ceiling and if there were lower clouds, but the exact nature of these lower clouds couldn't be determined from the report. If lower broken clouds were indicated, it wasn't possible to tell if they were 100 feet, 500 feet or 1500 feet. A better method of reporting cloud condition was badly needed. The changes instigated now give a complete picture of the weather at any station.

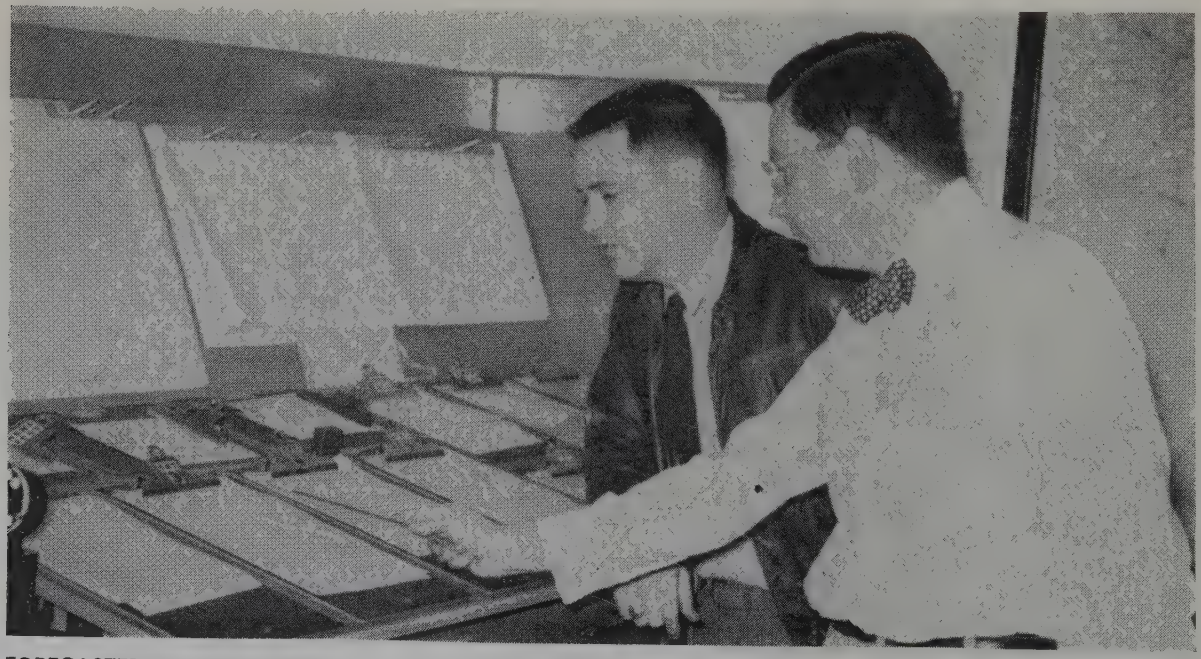
Immediately after the station identification, the clouds are given in their exact order. The lowest layer of clouds is always reported first, followed by the other layers in ascending order. For example, if a station has a scattered layer at 500 feet, thin broken at 1,000 feet and a measured overcast at 2,000 feet, it is now given as 5⊙ 10-⊙M 20⊕. The ceiling is always identified by the letter M, A, B, W, P or E. If none of these letters is found in the ceiling report, then the ceiling is considered to be unlimited. A layer of clouds that is transparent, sun or moon and stars visible through it, does not constitute a ceiling.

When a ceiling is given as "M," measured, "A," aircraft or "B," balloon, it is usually quite accurate. A ceiling that is reported as "W" (indefinite), "P," (precipitation) or "E" (estimated) is subject to larger error. For example, a precipitation ceiling can be 100 feet one minute and 1,000 feet the next.

Such obscuring phenomena as smoke and haze no longer are reported by using the symbol "X"; but are given as ⊙, ⊙ or ⊕. Whenever "X" is used, it means complete obscuration. The ceiling value after the "X" is the estimated distance the observer can see up into the fog or precipitation. If there is just a partial obscuration, the symbol "—X" is used. This means that the sky is partially hidden from the observer so that an accurate observation cannot be made.

The visibility, local weather, obstruction to vision, pressure, temperature and dew point sections remain unchanged, with one small exception in the local weather column. The symbol "—" has been added to indicate very light precipitation. It is used mostly in connection with icing conditions.

There is a change in the wind section. The peak speed of gusts and squalls is now reported following the average wind speed. (*Continued on page 57*)



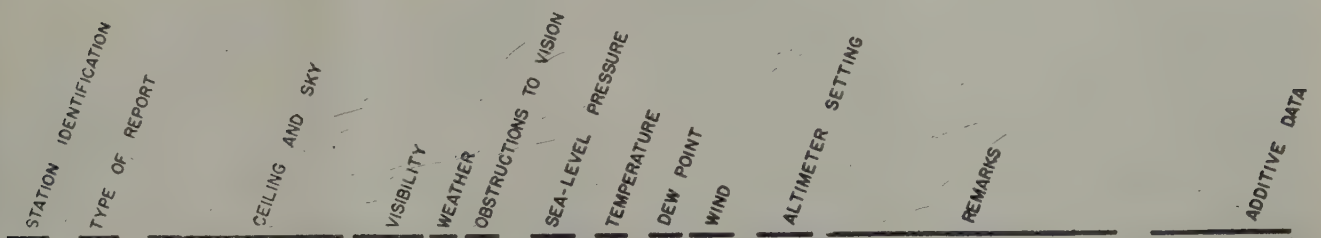
FORECASTER James Ferguson *(right)* goes over hourly sequence reports in airport office with Delta officer Gimson

WB FORM 631-1
(Formerly 4061)
Eff 6-1-51

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

EXPLANATION OF TELETYPE SYMBOL WEATHER REPORTS

(BASED ON INSTRUCTIONS IN WEATHER BUREAU CIRCULAR N)



EXAMPLE OF A RECORD-SPECIAL OBSERVATION AS IT APPEARS IN A SEQUENCE COLLECTION OF REPORTS. ELEMENTS OF THE OBSERVATION ARE EXPLAINED BELOW.

PIT — STATION IDENTIFICATION: Symbol for Pittsburgh.

S7 — TYPE OF REPORT: Special identified by letter "S." The "7" indicates the seventh special of the day. An out-of-sequence special report has a time group (24-hour clock, LST) following this designator, e.g., 0715E.

Record observations would appear on the sequence collection without the S7.

Local extra reports are indicated by "LCL" and a time group. (Local extras are transmitted on local teletype circuits only.)

3⊙M7V◐25⊕ — CEILING AND SKY: Scattered 300 feet; ceiling measured 700 feet variable, broken; 2500 feet overcast. Heights are expressed in hundreds of feet,(e.g., 40 = 4000 feet),and are prefixed to the corresponding sky-condition symbol. The letter "V" immediately following a numerical value indicates that the ceiling is variable by an amount reported in "Remarks."

A ceiling classification designator is prefixed to the ceiling layer only. Absence of a designator indicates an unlimited ceiling. Ceiling classification designators are:

A	aircraft	E	estimated	P	precipitation
B	balloon	M	measured	W	indefinite

Sky condition symbols are:

X - Sky completely hidden by precipitation or obstructions to vision.
○ - Clear - less than 0.1 sky cover.
◔ - Scattered - 0.1 to less than 0.6 sky cover.
◐ - Broken - 0.6 to 0.9 sky cover.
⊕ - Overcast - more than 0.9 sky cover.

Dark and thin layers are represented by the symbols plus(+) and minus(-), respectively, preceding the sky condition symbol to which they apply. A partial obscuration is represented by the minus(-) symbol preceding the "X."

In a combination of symbols, the phenomena coded in this portion of the report are reported in ascending order of height with respect to their distribution in space.

1 1/2V — VISIBILITY: One and one-half miles variable. Prevailing visibility is reported in miles or fractions of miles. The letter "V" immediately following a visibility value indicates visibility is variable in an amount reported in "Remarks."

L- — WEATHER: Light drizzle. Weather symbols are:

TORNADO. Not abbreviated. It is followed by a letter abbreviation showing the direction from the station.

T	Thunderstorm	R	Rain
T+	Heavy thunderstorm	RW	Rain showers
A	Hail	S	Snow
AP	Small hail	SG	Snow grains
E	Sleet	SP	Snow pellets
EW	Sleet showers	SW	Snow showers
IC	Ice crystals	ZL	Freezing drizzle
L	Drizzle	ZR	Freezing rain

A plus(+) following the symbols for precipitation indicates "heavy" intensity; a minus(-), "light"; a double minus(--), "very light"; the absence of a sign, "moderate" intensity.

FK — OBSTRUCTIONS TO VISION: Fog and smoke. The following symbols indicate obstructions to vision in aviation reports:

BD	Blowing Dust	GF	Ground Fog
BN	Blowing Sand	H	Haze
BS	Blowing Snow	IF	Ice Fog
D	Dust	K	Smoke
F	Fog		

146 — SEA-LEVEL PRESSURE: 1014.6 millibars. Three figures, representing tens, units, and tenths of millibars, indicate the sea-level pressure.

66 — TEMPERATURE: 66°F. A minus(-) preceding the figures indicates a temperature below zero.

65 — DEW POINT: 65°F. A minus(-) preceding the figures indicates a dew point below zero.

→3 — WIND: From the west, three miles per hour. Wind direction is indicated by arrows as follows:

↓	N	↑	S
↓↙	NNE	↑↗	SSW
↙	NE	↗	SW
←↙	ENE	→↗	WSW
←	E	→	W
←↖	ESE	→↘	WNW
↖	SE	↘	NW
↑↖	SSE	↓↘	NNW

Figures following the direction arrows indicate the speed in miles per hour. "C" indicates "calm"; the arrow and figures are omitted.

A plus(+) following the wind speed indicates gusts; the absence of a sign, a relatively steady wind. The peak speed of gusts follows the plus (+) symbol.

An arrow immediately following the current wind data indicates that the wind has shifted from the direction indicated by the arrow at the time indicated by a four-figure time group following the arrow. The time zone of the reporting station is shown by means of a letter. E.g., ↖1025E indicates a wind shift from the southeast at 1025 EST.

997 — ALTIMETER SETTING: 29.97 inches. Three figures, representing units, tenths, and hundredths of inches, indicate the altimeter setting.

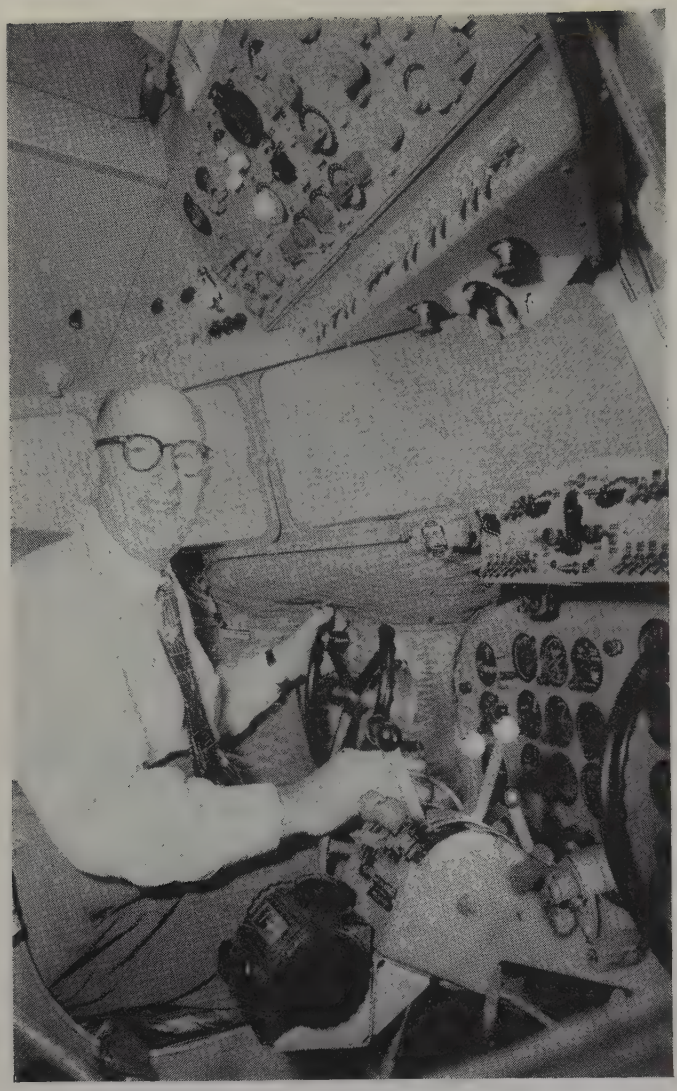
CIG 6V8 VSBY 1V2 — REMARKS: Ceiling variable six to eight hundred, visibility variable one to two miles. Teletype symbols, contractions, or complete words are used to report significant meteorological phenomena that are not reportable elsewhere.

808 6//6 — ADDITIVE DATA: Coded values relating to pressure and clouds. Precipitation data may also be included.

NON-METEOROLOGICAL DATA: Remarks concerning field conditions and the operation of radio facilities occasionally follow meteorological data.

WB Form 631-1

WEATHER BUREAU offers this explanation of teletype symbol weather reports issued hourly by field offices of the WB



EXECUTIVE PILOT Eddie Bellande, Navy pilot in World War I, has logged over 23,000 hours in 37 years of flying

EXEC CREW of Pan-Am Southern DC-3 is *(left to right)* D. Marrs, engineer; C. Conrad, chief pilot; W. Miller, copilot

What makes

By Eddie Bellande

Vice Pres., AiResearch Aviation Service
as told to Don Downie

Many a customer with a bright and shiny new executive transport has asked me, "What makes a good executive pilot?"

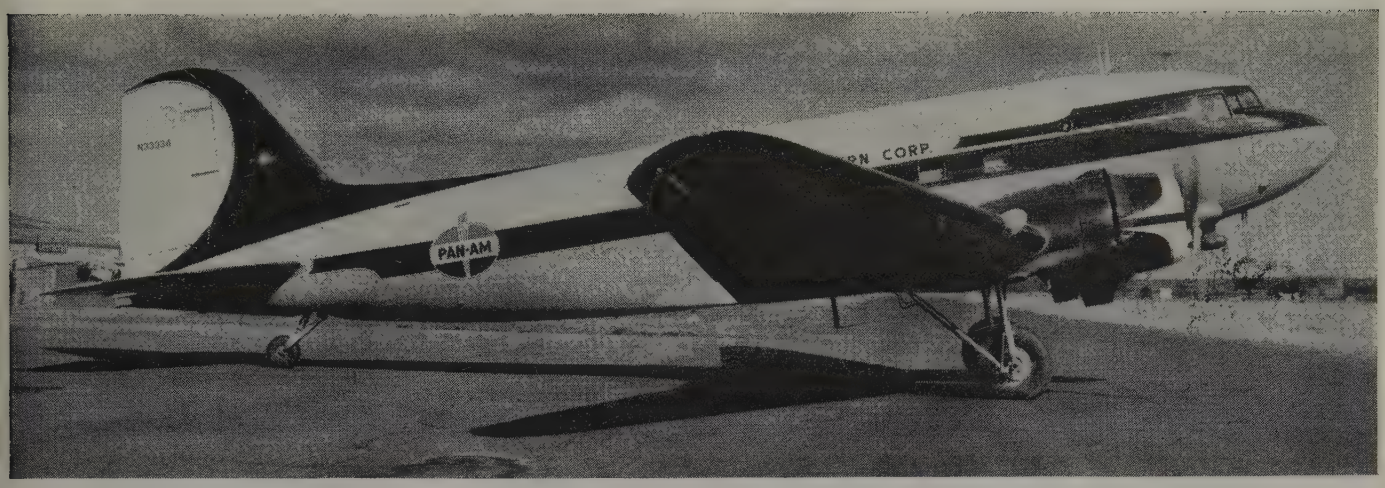
After 37 years of active flying—15 on the airlines and nine here at AiResearch, I have some rather definite personal opinions of what makes a good executive pilot.

When a company goes out to hire a pilot for their executive transport—big or small, I would advise picking one with at least 2,000 hours of flight time. Make sure that this is actual, not "Parker pen" log book time. It is easy enough to double check if flight log books look padded. While log books are no longer required, I don't know of a single good conscientious pilot who doesn't keep one for his own record—just like a flying diary.

Make sure that your potential company pilot has at least a thousand hours of cross-country time. If you plan to have your company aircraft go busting along the airways after dark, I would advise that at least half of this cross-country time have been at night. When it comes to night flying, check on what your prospective pilot has been flying at night. If he's been "gunning" along in a single-engined plane over anything but flat country after dark, take another look and make sure that he isn't a little too optimistic to make a good executive pilot. When you get all the "big wheels" of a company in one airplane, you don't want the pilot to be a "hot rock" who is prone to take chances.

If you plan anything but daylight, contact flight operations, your pilot should have an instrument rating. Find out how he got it in the first place, how long he's had it and what he's done with it. The bulk of the pilots available today gained their original instrument experience in the Services during World War II. Some of them are excellent instrument pilots; others are not too good. Here again, find out what type of planes your pilot has been flying on instruments in recent years.

Find out what kind of a professional background your pilot has had. Is he prone to accidents with his automobile? Does he pay his bills on time? Has he a family and does he get along well with his wife? All these things affect a pilot's ability.



PAN-AM SOUTHERN executive DC-3 carries three-man crew during slow months, two-man crew during peak months. Chief Pilot Conrad, Reserve Captain Bill Miller and Co-pilot-Engineer Marrs have Commercial, Instrument ratings

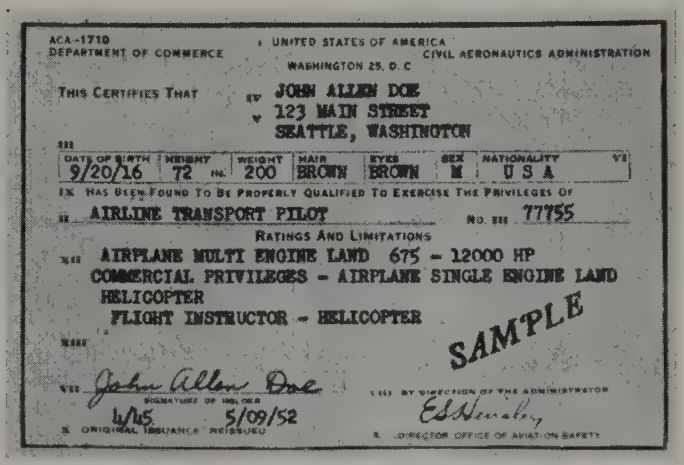
an EXECUTIVE PILOT?

From a purely personal viewpoint, I prefer older pilots with airline experience. Before the bulk of the Service-trained pilots raise a howl, let me make the first pitch. In executive flying, you are operating a private airline to anywhere. Granted that the MATS (Military Air Transport Service) crews have virtually airline experience, pilots with fighter and bomber background are not necessarily familiar with airway operation and civilian weather minimums. Under tactical conditions during the war, the weather "be damned" and you got back on the ground the best way you could. Under present-day radio aids and rigid traffic control, you can no longer operate that way.

I also have a personal preference for older pilots. A well-seasoned pilot "over 40" is going to be a dependable employee who will seldom stick his neck out and risk that valuable load of executives in the cabin. Just one bad executive accident could easily wipe out a whole company, so the pilot has a great responsibility on his shoulders.

With that responsibility should come a good salary. Naturally around our pilot's ready-room, we hear a lot of talk about the pilot's payroll. The lowest salary I've heard of for an executive pilot was $400 per month—and he's hunting for another job. The pay goes as high as $1200 per month, with an expense account that means a little more profit. Somewhere in the middle of that bracket is in line.

Naturally, the bigger the plane, the more responsibility and training re- (*Continued on page 54*)


ACA-1710
DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON 25, D. C.

THIS CERTIFIES THAT JOHN ALLEN DOE
123 MAIN STREET
SEATTLE, WASHINGTON

DATE OF BIRTH	HEIGHT	WEIGHT	HAIR	EYES	SEX	NATIONALITY
9/20/16	72 IN.	200	BROWN	BROWN	M	U S A

HAS BEEN FOUND TO BE PROPERLY QUALIFIED TO EXERCISE THE PRIVILEGES OF
AIRLINE TRANSPORT PILOT — NO. 77755

RATINGS AND LIMITATIONS
AIRPLANE MULTI ENGINE LAND 675 - 12000 HP
COMMERCIAL PRIVILEGES - AIRPLANE SINGLE ENGINE LAND
HELICOPTER
FLIGHT INSTRUCTOR - HELICOPTER

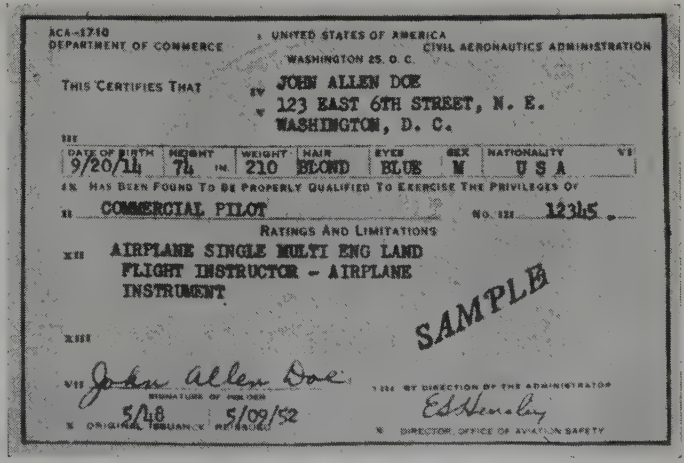
SAMPLE

John Allen Doe
SIGNATURE OF HOLDER

4/45 ORIGINAL ISSUANCE 5/09/52 REISSUED

BY DIRECTION OF THE ADMINISTRATOR
E S Hensley
DIRECTOR, OFFICE OF AVIATION SAFETY

AIRLINE TRANSPORT RATING *(above)* is the preferred ticket, according to the author, for pilots of executive aircraft. Commercial ticket with Instrument rating is a necessity. Many of best executive pilots have this ticket


ACA-1710
DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON 25, D. C.

THIS CERTIFIES THAT JOHN ALLEN DOE
123 EAST 6TH STREET, N. E.
WASHINGTON, D. C.

DATE OF BIRTH	HEIGHT	WEIGHT	HAIR	EYES	SEX	NATIONALITY
9/20/14	74 IN.	210	BLOND	BLUE	M	U S A

HAS BEEN FOUND TO BE PROPERLY QUALIFIED TO EXERCISE THE PRIVILEGES OF
COMMERCIAL PILOT — NO. 12345

RATINGS AND LIMITATIONS
AIRPLANE SINGLE MULTI ENG LAND
FLIGHT INSTRUCTOR - AIRPLANE
INSTRUMENT

SAMPLE

John Allen Doe
SIGNATURE OF HOLDER

5/48 ORIGINAL ISSUANCE 5/09/52 REISSUED

BY DIRECTION OF THE ADMINISTRATOR
E S Hensley
DIRECTOR, OFFICE OF AVIATION SAFETY

Differential and Reverse Current Relays

By Robert P. Mosley

The development of the 30-volt, 200- to 400-ampere electrical systems was one of the most important factors in the rapid advancement of the aircraft industry. Through the utilization of the more efficient, higher capacity system it became possible to use this source of d-c electrical energy to control and actuate more accurately all the accessories and instruments of the aircraft.

Further experimentation and development of more precise instruments, accessories and remote-control equipment allowed faster and more accurate movement of turrets, gun firing, bomb release, wheel retraction, fuel transfer, heating, lighting, battery disconnect and many equally important functions in the aircraft without the possibility of human error.

With the increased application of the more sensitive remote-indicating and actuating units, from the standpoint of the amount of electrical energy used for actuation and indication, it became necessary to develop a positive method of safeguarding the serviceability of these units in the system.

This was accomplished by the development and incorporation, in the electrical system, of a system of relays and switches which were automatically controlled by the electrical energy of the aircraft itself.

The conformation of these electrical relays and switches had to be in accord with all the other component parts of the aircraft's electrical system. Size, weight, the ability to perform during temperature changes ranging from –60° to 200° F, the ability to withstand intense vibration and the ability to operate throughout barometeric pressures ranging from 29-inches of mercury at sea-level to 5.5-inches of mercury at approximately 40,000 feet above sea-level were just a few of the obstacles overcome in the development of a protective system.

Although an enormous background of material was available to the industry's engineers in the stationary contact field, these protective units were of such a size and capacity as to render them useless in aircraft application. Thus, the engineers found themselves once more in the same position they had occupied during the development of the multiple contact voltage regulator.

The construction of a satisfactory relay or switch, designed for a specific purpose in the electrical system of the aircraft, resolved itself into the following categories: the contacts, the magnet, arrangement, mounting and special features. Also, of importance was the question of whether the circuit required single-pole single throw, single-pole double-throw, double-pole single-throw or double-pole double-throw switches.

The contacts had to be of a material that did not form non-conducting oxides or films offering high resistance in the circuit. Metals which were resistant to the transfer of particles from one contact to another and resistant to welding had to be developed. Transfer and welding are caused by the terrific heat generated by the electric arc between the contacts upon opening and closing. Transfer and welding was further prevented by the use of a blow-out magnet, which we shall discuss later.

The usual method by which the contact points were fastened to the contact plates was brazing. Although this offered a secure and fairly low resistant bond, a more efficient and satisfactory method was devised. In this method the ingredients of the contact points are ground, thoroughly mixed and molded under controlled pressure directly to the contact plates. Serrations on the contact plates not only anchor the contact points to the contact plates more firmly but guarantee a much lower resistant bond. And a feature of great importance: the density of the material used in the contact points can be controlled through the pressure applied during molding.

The arc, which we mentioned previously, is an inherent characteristic of all d-c relays and switches and, therefore, must be considered in design and construction. It was and is necessary to correlate the density of the metals used for the contact points and the bounce of the contact plate and armature in order to determine the correct contact pressure to minimize the intensity of the arc created—again reducing the tendency of transfer and welding. As an aid to destroying this arc more rapidly, the mounting brackets were designed with iron pole pieces which concentrated the electromagnetic field across the contact surfaces. This electromagnetic field, together with the forces of the opening spring and the contact spring (contact closed), imparts a blow-out action when it (the magnetic field) is destroyed.

A typical diagram of the blow-out mechanism in our present-day relays and switches is shown in Figure 1. The arc horns are used as the path for the arc created by the opening of the contacts. The arc is blown along these horns, away from the more sensitive contact points, hence the name "blow-out" mechanism. The shell and the bracket of the unit also greatly reduce the heat generated by the coil.

There are several distinct forms in which operating magnets can be constructed and each has certain characteristics which determine its suitability for particular installations. All have many common properties so a complete analysis of the operation must be made to determine the strength or the pull of the magnet at various plunger positions. The

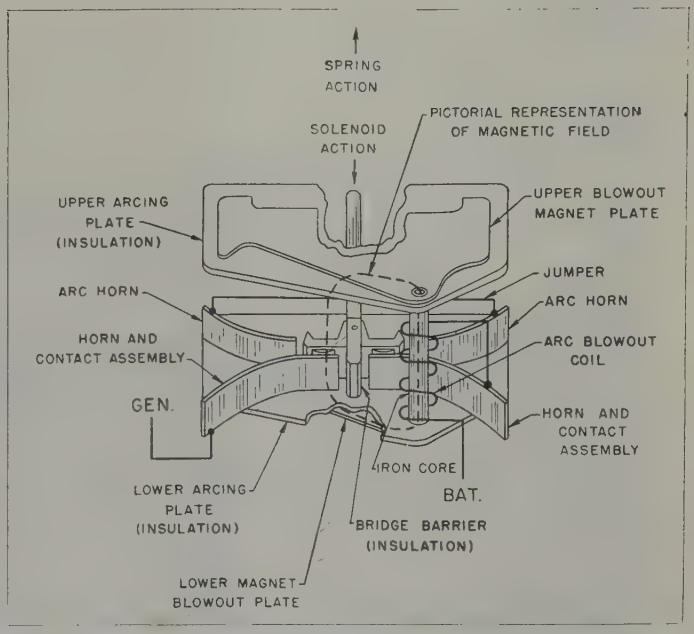


FIG. 1—Schematic drawing is of blow-out mechanism in magnetic present-day electrical relays and switches

CORPORATE DC-3's for the most part have converted to 30-volt systems to provide more power for extra equipment

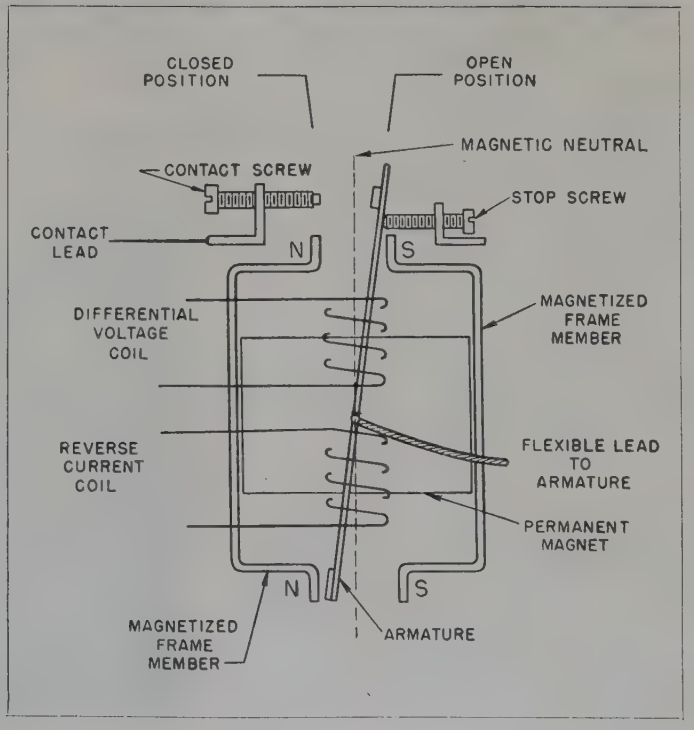
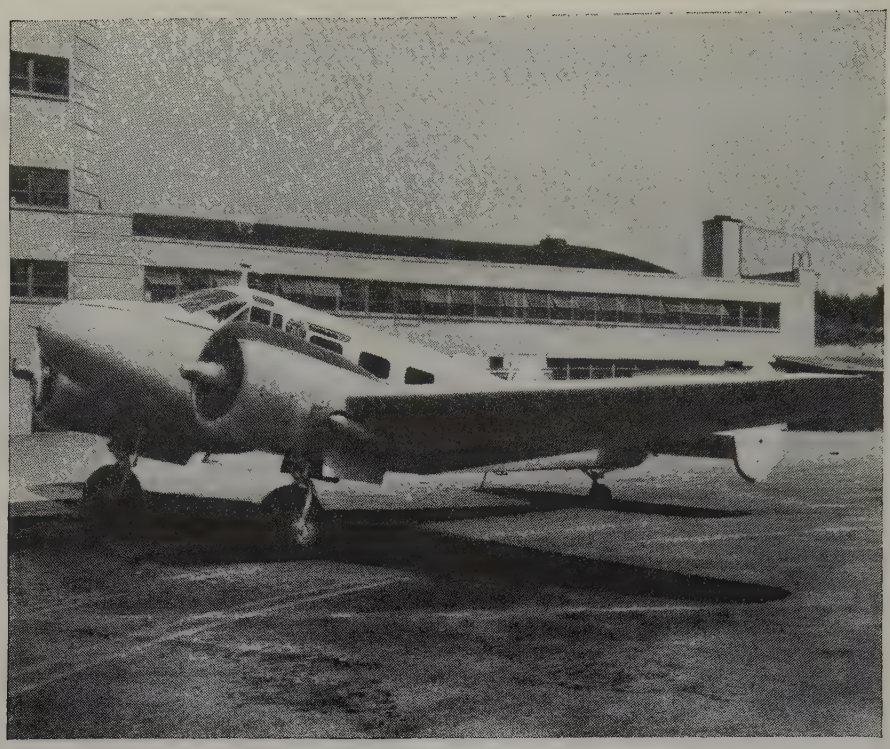
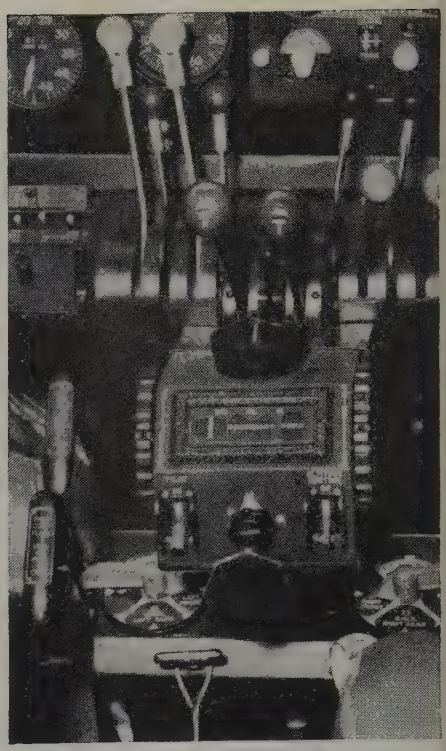


FIG. 2—Main components of polarized relay are shown in this drawing of differential, reverse-current relay

spring forces and the magnetic force must be plotted to determine the opening gap position at which the plunger is prevented from moving to its sealed position. The force required is determined by the accelerating forces to which the contactor will be subjected and the weight of the moving parts. In a balanced unit in which the accelerating forces are cancelled, the force is determined by the electrical energy required to open the contacts with sufficient speed to break the arc quickly. When the plunger moves toward the sealed position, the opening spring-forces increase. This rate of increase must be kept to an absolute minimum as an increase in this force demands an increase in the magnetic attraction for a given (*Continued on page 46*)



TWIN-BEECH is one of a fleet of executive aircraft owned and operated by Sinclair Refining Company. Pilots are Louis Houck and H. L. Wells. Copilot is James M. Muncil



EQUIPMENT on the Sinclair D18S includes the Lear Orienter and *(above)* the Sperry A-12

SKYWAYS for BUSINESS

News notes of pilots, plane owners operating aircraft in the interest of business

U.S. Steel Corporation Buys Super DC-3's from Capital

Three Douglas Super DC-3's owned by Capital Airlines have been sold to the U. S. Steel Corporation for executive travel. The sale of the Super DC-3's was made under an arrangement which is believed to be the first of its kind ever made by a scheduled airline. The planes will be based at U. S. Steel headquarters at Pittsburgh and will be operated by Capital Airlines flight crews. The Super DC-3's also will be maintained by the airline's maintenance department.

Officials of the Douglas Aircraft Corp., recognizing a potential market for the sale of the Super DC-3 to other large corporations for executive travel, played a big part in the negotiations. This is the first time that such an arrangement has been made.

Aircraft Vacuum Cleaner Developed by Hoover Co.

A small hand vacuum cleaner operating with a 24-volt motor has been developed by The Hoover Company for cleaning upholstery and carpeting in executive aircraft, private planes, etc. Called "Dustette," the handy little cleaner weighs slightly over five pounds and comes complete with an 18-foot brown cord. It stands just six-and-a-half inches high. Motor of the "Dustette" is of the AC-DC type, and its five-bladed fan is of die-cast aluminum three-and-a-half inches in diameter. Slide-button type switch is fully insulated and mounted in a recess at the top of the handle. A rubber-covered steel wire storage hangar, suitable for mounting on a wall or door, is included. The "Dustette" sells for $28.95.

UAL Develops High-Visibility Aircraft Tail Light

A rotating red light which makes aircraft highly visible at night is being installed on the vertical stabilizers of United Air Lines' entire fleet. Developed by UAL, the light is a sealed-beam 100-watt lamp of about 18,000 candlepower and is mounted under a red plastic dome atop the tail. Two reflectors, suspended over the lamp and revolved by a

HOOVER COMPANY D18S is piloted by Marshall McDowell *(left)*, shown here with his wife and son, and Copilot Dave Allen. Plane was at SAC for an automatic pilot installation

motor at 60 rpm, cast fan-wise beams 180° apart in the horizontal plane. One beam is 30° below the horizontal plane, the other 30° above. Both overlap 5° at the horizontal. Viewed at a distance, from above or below, the light flashes every second. When seen from the same altitude, it flashes twice a second. The installation weighs just a little over three pounds.

Five A-26's Added to Executive Fleet

Five former USAF A-26 light bombers are being converted into executive-type planes at Grand Central Aircraft, Glendale, Calif. A sixth A-26, the first one to be converted to company operations as an executive transport, is in for overhaul.

Conversion work on the five A-26's is being done for the Continental Oil Co., Stanlin Oil Co., Brown Paper Co., and Texas Railway Equipment Co., while the overhaul on the sixth A-26 is for Standard Oil of Indiana.

CAA Announces Revised Fees for Washington Nat'l

A revised system of landing fees for all airplanes engaged in commercial or executive flying went into effect at Washington National Airport, June 1, 1952. No landing fee will be charged private planes, except those which are fitted to accommodate more than 10 passengers. The new schedule of fees for commercial and executive operations is:

Landings

Aircraft Weight	Fee
Up to 10,000 lbs	$1.00
10,000- 20,000 lbs	1.50
20,000- 30,000 "	2.50
30,000- 50,000 "	4.00
50,000- 70,000 "	6.25
70,000-100,000 "	8.00
100,000-125,000 "	12.00

Parking

1 to 5 place planes	$1.00
5 to 10 " "	1.50
10 to 40 " "	3.00
Over 40-place "	5.00

(No charge for planes which land for fuel or to load or unload cargo and take off within 30 minutes)

DUSTETTE is small electric cleaner that operates on 24-volt system; developed by Hoover

. . . in the Corporate Hangar

The Ohio Oil Company's Cessna 195 has been in the shop at Roscoe Turner Aeronautical Corp. for a complete Lear installation. Home base for the plane is Findlay, Ohio.

Cornell Dubilier's DC-3 is out of the hangar at Atlantic Aviation, Teterboro, N.J., after a new custom radio installation, complete with master control panel. The new system includes dual ADF's, ARC 15C Omni, Type 17 VHF Communication system, Bendix TA-18 180-channel transmitter, MN-53 Marker Receiver, Range Receiver, ARC F-11 Isolation Amplifier with cockpit loudspeakers, and a Bendix RTA-1B radio telephone. A 16-inch Admiral TV is installed in the cabin.

The Douglas B-23 belonging to Standard Oil Company of California has been at AiResearch for annual re-licensing and a new custom interior. Standard's representative on the project was Arnold Horton.

Old Line Insurance Company *Bonanza* is in the hangar at Roscoe Turner Aeronautical for engine overhaul, re-upholstery and a new paint job.

Raoul Castro of International Harvester has been at Beldex Corp., a Remmert-Werner affiliate, overseeing conversion work and overhaul on the company DC-3.

Bristol-Myers' DC-3 is back in service after landing gear repairs at Southwest Airmotive.

Pilot John Boomsha flew the J. I. Case Company Twin-Beech to SAC for radio work.

Nev Watson and Dick Gaderra, pilot and copilot of New York Rubber Corp.'s new Twin-Beech, have been at Atlantic Aviation overseeing installation of a Bendix TA-18 180-channel VHF Transmitter and an MN-53B three-light Marker Receiver in the D18S.

Arizona Public Service's Twin-Beech has been in the hangar at Southwest Airmotive for a double engine change and 1,000-hour inspection. Pilot Frank A. Hollorin brought the plane in from Phoenix.

Pittsburgh Plate Glass' newly converted DC-3 is back in the hangar at Remmert-Werner for additional radio equipment. Pilot and copilot are Buck Newton and Bob Baltes.

Neil Fulton, Chief Pilot for Mathieson Chemical Corp., has the DC-3 back in service after an engine change at Atlantic Aviation, Teterboro.

Radio Corporation of America has its deluxe Douglas flying after conversion work by Beldex Corp. RCA's plane has one of the most elaborate and complete radio and intercom systems ever installed in an aircraft.

Dick Robinson, pilot of Firestone Tire & Rubber Company Lockheed *Lodestar*, knows how to take advantage of time. While the *Lodestar* was in the hangar at Southwest for 1,000-hour check, Dick returned to Akron, was married and went on a honeymoon.

Morrison-Knudson Company, Inc., Boise, Idaho, has had its DC-3 at AiResearch for an engine change (P&W R1830-92 to R1830-94).

Lodestar belonging to Cappel, MacDonald Company is back in service after installation of a complete Collins Radio layout at Remmert-Werner, Chief Pilot Jack DeWolfe brought the ship in.

Cal Copeland is flying copilot with bridegroom Poddy Parish, pilot of the Trinity Drilling *Lodestar*. Copeland replaces Joe Mims who is now mechanic on the Dresser Industries crew. Pilot Poddy Parish put a wedding ring on Jo Kiesewetter's finger last April.

Bob Olson brought the National Lead Company Douglas to Remmert-Werner for a dual prop change.

Sherman Kennedy is flying a new Bell helicopter in herding cattle on the Waggoner ranch in Vernon, Texas.

Ernie Davis and Paul Wheeler brought their DC-3 into Remmert-Werner for installation of a Janitrol Heater.

CAOA REPORT . .

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. CAOA headquarters are located at 1029 Vermont Ave., N.W. Washington 5, D. C. Phone: Metropolitan 0714.

Full Fuel Cooperation

With the recent rationing of fuel, CAOA members were, in many instances, severely handicapped in their operations due to the lack of high-octane gas. Nevertheless, CAOA cooperated with the Government Order PAD-6 100 per cent.

CAOA headquarters mailed its members the complete PAD-6 and other instructions of the Government fuel order just as soon as copy could be obtained from the Interior Department, and which was just a few hours before the Order became effective.

The order rescinding PAD-6 was mailed from CAOA headquarters over the Memorial Day holiday, so that all members were given prior notification of the lifting of the fuel restrictions on June 3rd.

The 65 per cent fuel allotted to aircraft operators was based on the number of hours flown in March, 1952. For various reasons many corporations did not fly their aircraft during that month. Therefore, by letter to the Petroleum Administrator, they had to request special allotments. CAOA headquarters coordinated efforts between its members and the Department of Interior on these requests, and reports that E. O. Jones, who was in charge of granting these fuel allotments, was extremely cooperative with all corporation owner's requirements.

It is interesting to note that the CAOA bulletin, including the PAD-6 that CAOA mailed, was so complete in its information that many extra copies were requested. Coincidentally, many of the requests for copies were received from the large oil companies. Apparently, CAOA's mailing was the only set of complete instructions sent out to the aircraft industry.

Runway Preference Rules

Establishment of an "order of preference" of runways at some airports, starting with the runway permitting flight over least-populated areas and ending with most heavily settled areas, has been proposed as part of CAA's recently published preferential runway use program. The system calls for new procedures in VFR operations at airports where CAA operates a control tower and where it appears necessary to eliminate or lessen noise and/or hazards. CAA states the decision to adopt these procedures is to be determined through coordinated action by the Air Transport Association, Corporation Aircraft Owners Association, Air Line Pilots Association and other local users, as well as by the CAA and airport management.

1. Procedures apply in VFR weather only.
2. Pilot retains full authority. He may request another runway when he thinks the preferential runway is not suitable.
3. With wind velocities of less than 15 mph, tower will select the runway having the highest priority in the appropriate order of preference, but with a crosswind not exceeding 80° to the right or left of the nose of the aircraft. (This supersedes the use of a "calm wind" runway at locations where the preferential runway system is established.)
4. At higher wind velocities, runways should be assigned as dictated by wind direction.
5. In all cases, wind direction and velocity will be stated.

Published regulations of the CAA Administrator and the ANC Manual, both of which specify that aircraft shall ordinarily be authorized to use a runway most nearly aligned into the wind when the surface wind is 6 mph or more, may be deviated from to the extent required by the new procedures. CAA indicated that formal amendment of the earlier regulations would be made in the near future.

Thunderstorm Discussions at St. Louis

Mr. Ralph E. Piper, Chief Pilot for Monsanto Chemical Company, is organizing and making the necessary arrangements in conjunction with CAOA National Headquarters in Washington, for the regional Safety meeting in St. Louis, Missouri, at the Kratz Airport at 8:00 P.M. July 14. The topic will be "Safety in Weather Flying," with emphasis on thunderstorm activity.

Ralph has made arrangements to have two outstanding authorities present. They are

1) Col. Diran Arakelian, Commanding Officer, Base Weather Group, Scott Air Force Base, Belleville, Illinois, who is a meteorologist with a vast knowledge of thunderstorms and their make-up.

2) Maj. William H. Best, Headquarters, Air Weather Service, Andrews Air Force Base, Washington, D. C. who has been conducting extensive thunderstorm research under actual conditions.

All pilots are invited to attend, as this will be an outstanding discussion on weather flying.

New Airway Network June 1

As of June 1, all Corporate owners have available 45 thousand miles of VFR airways in the domestic United States. This is in addition to the existing 65,000 miles of LF airways.

Charles F. Horne, Administrator of Civil Aeronautics, U. S. Department of Commerce, told CAOA's Herb Fisher that the new airways eventually will largely replace the existing airway network. In most cases the new airways are superimposed upon, or follow rather closely, the existing routes.

Pilots will fly the new airways by using omniranges, modern VFR radio ranges which offer many advantages over the older four-course ranges. The omniranges are located approximately 100 miles apart along the new airways.

The new airways are referred to as "Victor" airways, and are numbered like highway routes. Odd-numbered Victor airways run north and south while even numbers designate east-west routes.

The Victor airways, like the LF airways, are 10 statute miles in width. For traffic control purposes to insure safe separation of aircraft, each airway is divided into 1,000-foot vertical lanes.

Aviation Noise Reduction

CAOA is represented on the National Aviation Noise Reduction committee that has

TWIN-BEECH is owned and operated by Universal Moulded Products Corporation, Philadelphia. A member of CAOA, Universal bases its plane at Wings Field in Ambler, Penna.

been established under the sponsorship of CAA. Special working groups, to investigate various aspects of the aircraft noise problem, have been in session and recommendations will be made soon.

N. Y. Police Aid Pilots

The New York State Police wish to remind CAOA pilots that its plan initiated five years ago for making its facilities available to pilots when normal radio contact or CAA facilities are not functioning or readily available for the closing of flight plans still remains in effect. Pilots wishing to make contact with their home, airport or destination airport can use the free telephone service available by contacting the State Police.

New Landing Aid

Operation of the Instrument Landing System, (ILS) used to guide CAOA and other aircraft to landings at major airports, will be improved by new dual transmitters installed by the CAA.

New glide slope transmitters are being installed as rapidly as equipment is received from the manufacturer. The new transmitters, installed in duplicate to provide standby service, will replace war surplus transmitters at the 98 domestic airports now served by ILS. They also will be installed at about 75 additional airports where ILS is scheduled.

The new transmitters and associated antenna are designed to avoid any changes in the glide slope angle caused by snow on the ground, changes in the water table, etc. They will increase the usable range of the glide slope from 10 to about 30 miles, and provide more precise on-and-off-course guidance.

An improved monitoring system is being installed with the new transmitters. Independent receivers continuously sample the output of the transmitter. If it changes in path width, path angle, or signal level, red lights flash and bells ring in the control tower. The traffic controller can then immediately switch to the standby transmitter.

Cost of the new electronics equipment is approximately $7500 for each location.

CAOA Representation

Cole Morrow, chairman of the CAOA Board, was invited by officials of the Indianapolis Municipal Airport (H. Wier Cook) to appear in their behalf when the Airport Use Panel recently held a public hearing in that city.

Indianapolis Airport officials felt that since corporate aircraft utilized that field to a great extent, that it would be detrimental to them and all other corporate users if the military was allowed to establish full operations at this facility.

Fred W. Summer, local airport official and CAOA member, indicated that there was no justification for the military using Wier Cook field when there were three large Air Force bases within a 75 mile radius of Indianapolis and which were at present inactive.

Hq. Visitors

The following were recent visitors to CAOA headquarters in Washington, D. C.

F. T. Fuetsch
Pratt and Whitney Aircraft
Hartford, Conn.

Al Bridgeford
Helicopter Test Pilot
Rockville, Maryland

John D. Scott
Corporation Pilot
Overland, Missouri

John Yost, Chief Pilot
Armstrong Cork Co.
Lancaster, Penna.

O. L. Grimes, Chief Pilot
Stokely Van Camp, Inc.
Indianapolis, Indiana

Donald Webster, General Manager
National Aeronautics Assoc.
Washington, D. C.

Maxwell W. Balfour, Vice-Pres.
Spartan Aero Repair
Tulsa, Oklahoma

Richard H. Rush, Wash. Rep.
Spartan Aero Repair
Tulsa, Oklahoma

Harry J. Beu, Pilot
Buffalo, N. Y.

Cole H. Morrow
J. I. Case Co. and Chairman CAOA Board
Racine, Wis.

R. W. Lane, Chief Pilot
Food Machinery & Chemical Corp.
San Jose, Calif.

H. H. Glass, Chief Pilot
R. D. Weber
Texas Illinois Natural Gas Pipeline Co.
Chicago, Illinois

M. V. McDowell, Chief Pilot
D. W. Adams, Pilot
The Hoover Company
North Canton, Ohio

It is hoped that all members of CAOA and other corporate aircraft owners will visit CAOA headquarters so that they may become familiar with the many activities that the organization is participating in on their behalf.

Rear Vision

CAA's Technical Development and Evaluation Center at Indianapolis has announced development of a transparent plastic bubble which can be mounted in a cockpit canopy above and ahead of the pilot and used as an effective rear-view mirror that will pick up even small aircraft at quarter-mile rearward distances. Mirror is light in weight and easy to install, and CAA will approve installations after demonstrations to see that they are properly installed.

Pipeline Patrol Not Guilty

CAB's safety analysis division chief, Ben W. Ashmead, told the National Agricultural Aviation Conference at Denver that 90 per cent of the fatal accidents in agricultural flying are caused by error, cocksureness or complacency on the part of the pilots. The number of agricultural aviation accidents rose from 31 in 1942 to 441 in 1950, he said.

CAOA Calendar and Associated Events

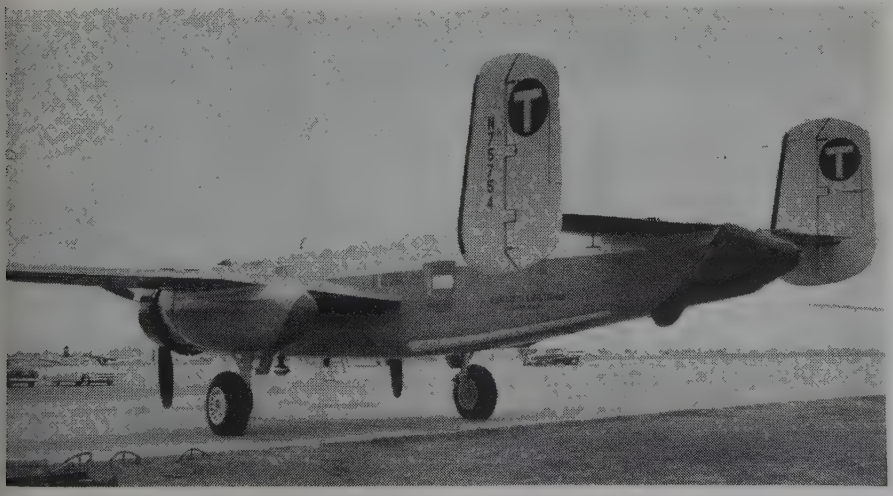
July 14, 1952— St. Louis Division of CAOA and CAA — Regional Air Safety Forum, Kratz Airport, St. Louis. The topic will be "Weather Flying" with special emphasis on Thunderstorms. Official contact, Ralph E. Piper, Chief Pilot, Monsanto Chemical Co., St. Louis, Missouri

Sept. 25-26— Annual meeting and forum of CAOA in Chicago. Blackstone Hotel

Oct. 9, 10, 11— Cole H. Morrow, Chairman of the Board of Directors for CAOA, will be official representative at the International Northwest Aviation Council 16th Annual Convention, Great Falls, Montana.

Dec. 1952— Chicago division of CAOA and CAA Regional Air Safety forum. The topic will be "Weather Flying" with special emphasis on Icing conditions.

ALBERT TROSTEL & SONS CO. operates a *Bonanza* and a North American B-25J *(below)*. Also a member of CAOA, the Trostel Co. bases its B-25 at Milwaukee. Tom Neyland is the pilot



"Careless gamboling along the skyways is gambling with your life."

DILBERT

By S. H. Warner and R. Osborn

Be a Gas Miser—They can bring in a hundred new oil wells every day and store millions of gallons of gas at every airport, but unless you have some of that stuff in *your* tanks when you need it, it isn't worth a tinker's damn.

Normally, it doesn't make any difference how much gas you waste; you'll still have enough to complete your flight. But just keep on flying and the time will come when a few gallons of it will be worth more to you than all the diamond mines in Africa.

Of course, all your flights are planned to bring you in with a reasonable margin of safety, but as

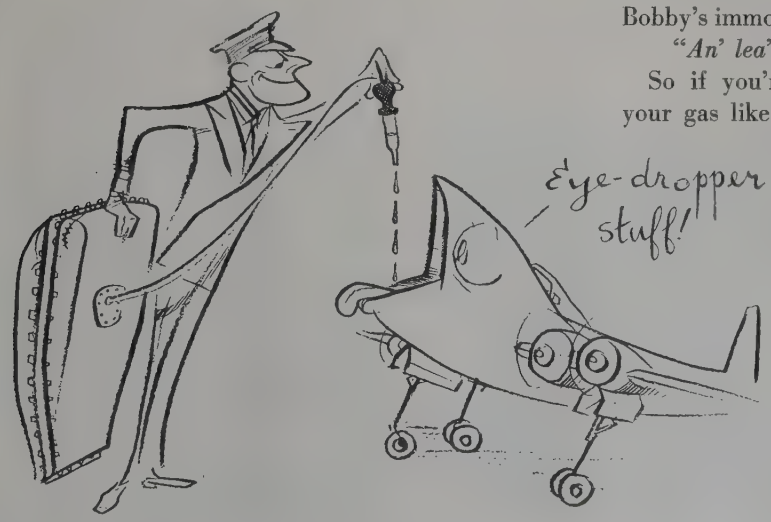
Bobby Burns aptly wrote so long ago:

"The best-laid plans o' mice and men,
Gang aft a-gley."

For instance, you might make a slip in navigation some day; others have. Or you might arrive at your destination only to find the field and all near-by alternates socked in. Then, if you don't have enough gas to stick it out, the next line of Bobby's immortal ode "To A Mouse" is also for you:

"An' lea'e us naught but grief and pain."

So if you're smart, you'll learn how to hoard your gas like a miser; how to get the most miles, or the most hours (there is a difference) out of your limited supply of fuel. You'll practice fuel economy by finding out and using the best power settings for your plane-engine combination, and you'll learn how these settings change for various load conditions and altitudes. There's no need to overtax your memory; make a chart and shellac it to the (*Continued on page 50*)



STRATO-PORT, as suggested by Assen Jordanoff, would be 10,000 feet long, divided into two sections of 5,000 feet, each section a runway in itself. Hub would be 500 feet in diameter

ASSEN JORDANOFF, designer of one-runway airport, is pilot, aeronautical engineer

One-way Airport

Over the years there has been very little that could be called new in the engineering and construction of airports. Hundreds and thousands of acres of land have been required to provide communities with air service, a vital necessity in the economic picture of daily life. Following the unfortunate and tragic accidents in the vicinity of Newark Airport, the citizens of the communities in that area and in other areas around the country set up a hue and cry against the operation of aircraft over populated areas. Citizen committees were formed; government committees were formed; and industry committees were formed—all to study the airport problem and to find an answer that would eliminate what the citizens believe to be the existing danger of aircraft operations in and out of their communities.

One suggestion was put forth by Assen Jordanoff, well-known flyer, aeronautical engineer and author. Mr. Jordanoff's suggestion involves the design of the airport itself, and is being seriously considered by the aviation industry. It is a design which would revolutionize the layout of airports by routing all aircraft to a single, wind-sheltered runway.

The plan would send all air traffic in and out of the airport over the least populated areas and would end the familiar criss-cross pattern of numerous runways for different wind directions.

Mr. Jordanoff calls his project "Strato-Port." Its main features are an ingenious 50-foot-high fence designed to "absorb" crosswinds, and a 10 per cent incline at the ends of the runway, this incline to act as a brake on landing and to boost momentum for take-off.

According to Mr. Jordanoff's plan, the Strato-Port would be 10,000 feet long, divided into two sections of 5,000 feet. Each section would be a runway in itself. The hub of the two sections would be a raised circular platform, 500 feet in diameter, to which both runways rise at a gentle 10 per cent slope.

Referring to the drawing above, aircraft would be taxied from the hangar apron through the opening at the hub. Planes would then move into their take-offs down the incline, the extra momentum provided by gravity being equivalent to the power of another engine.

In landing, the aircraft would end its run by coming up the incline to the circular platform. The braking affect of the incline, according to Mr. Jordanoff, would be another safeguard for slowing aircraft down without the use of brakes that cause skids under icing conditions.

"It would obviate the use of reverse props and be particularly useful when we get to jet transports," Mr. Jordanoff commented. "So far jets have found no reverse power device that is mechanically feasible."

The 50-foot wind fence would be built in sections, each section easily replaceable in case of damage of any kind. The fencing is so designed to act as a wind absorber, to dissipate the force of the wind. An airplane coming in or going out would be using a runway sheltered from all crosswinds.

At the present time, the numerous runways and sprawling acreage needed by airports is due to the dangerous effects exerted by crosswinds above a certain velocity. To avoid these crosswinds, runways are built in different directions so that aircraft landing or taking off can face into the prevailing wind as nearly as possible.

The Strato-Port designed by Assen Jordanoff eliminates the danger of crosswinds in aircraft operation and safeguards the community by enabling the runway to be built so that operations in and out are over less populated areas. The routing of take-offs and landing are over the most sparsley settled sections of cities without moving present airport sites and without changing preferential flight patterns when the winds change.

Another point in favor and primary purpose of the Jordanoff Strato-Port is the improvement in the safety factors at or near airports by imposing less strain on the engines at take-off, the added momentum of the incline permitting the use of less power from the engines. The Strato-Port also rules out so-called combination approaches in bad weather, *i.e.*, instrument approaches toward the ILS runway changing to visual landings on other runways. In the case of the Strato-Port, the ILS runway would be the only runway.

Mr. Jordanoff's project has received the endorsements of several airport and airline managements and plane manufacturers.

Operation Safety

(*Continued from page 12*)

safe operational procedures. Standardization is a religion in SAC that is paying profitable dividends in efficiency and safety. From the time a combat crew is assigned a mission to fly, its major activities—preflight, crew inspection, take-off, climb, bomb run, landing and postflight inspection—are guided by check-lists.

Every man assigned to a bomber crew is provided a booklet covering the SOP's for his position, both under normal and emergency conditions.

The thorough preflight inspection procedures for a B-36 require crews to report to their big bombers at least two hours prior to take-off. F-84 pilots require 20 minutes to inspect the 73 external and 49 cockpit items on their visual preflight before they start engines. But, in all cases—the B-36, B-29 or B-50 crew and the F-84 pilot know their aircraft is safe and ready to fly the grueling mission ahead.

The proficiency of each crew in SAC is checked twice annually in rigid standardization rides. Before each mission, the aircraft commander personally inspects the personal and emergency equipment of each crewman to insure it is in proper condition. In flight, bail out and ditching drills are staged frequently, and the pilots and the flight engineer practice feathering procedures and other emergencies.

The downhill trend of SAC's accident rate is in direct proportion to the increasing emphasis placed on safety. When Colonel Ellis was assigned as chief of the Flying Safety branch two years ago, he quickly realized that he and Lt. Col. Wayne J. Seward, who comprised the entire branch, were incapable of doing more than handle the routine work required in investigating and studying accidents and making recommendations for corrective action. They were constantly on the defensive—taking care of accidents that had already occurred rather than seeking new ways to prevent future crashes by ferreting out and correcting procedures and hazardous conditions before they evolved into costly plane crashes.

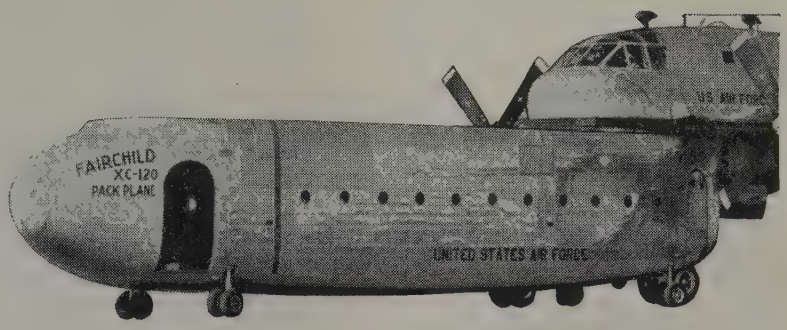
Obviously, the initial requirement was to obtain outstanding personnel. His first move was to bring in Maj. W. J. Crutsinger, a former base flying safety officer who had achieved an admirable reputation at March Air Force Base for having one of the most successful air safety programs in the entire Air Force.

After setting his own house in order, Colonel Ellis recommended to his chief, General Montgomery, that flying safety officers in the various wings be assigned on a full-time basis. Maj. Gen. Thomas S. Power, deputy Commanding General, approved the move and, together with General LeMay, was influential in establishing the requirement. Previously the job had been an extra duty offering little prestige and no opportunity for promotion. But merely making the job a full-time assignment wasn't enough; Ellis knew he had to get the best available officers and inject them with his own enthusiasm if success was to be realized. This he has gradually accomplished.

Today, every base or wing flying safety officer is a highly qualified, experienced

(*Continued on page 40*)

The XC-120 Packplane is a lot of plane to polish...



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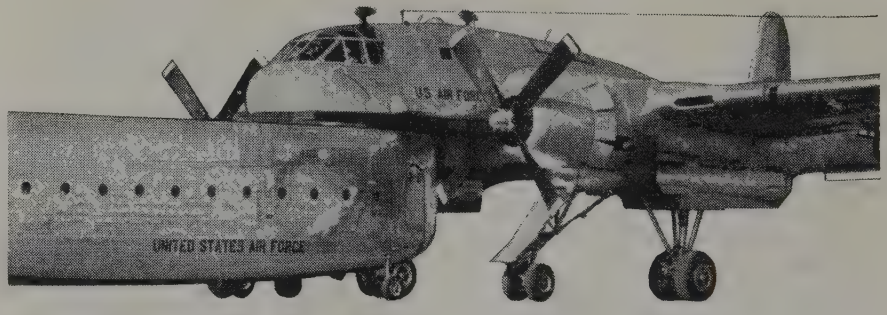

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Operation Safety

(*Continued from page 39*)

pilot. Most are former B-29, B-50 or B-36 aircraft commanders, many with commercial airline experience, who know their airplanes and a combat crew's problems intimately. Each has direct access to the division or wing commander at his station, thus assuring that accident prevention measures he recommends receive immediate attention and the command support necessary to implement them.

Conferences are conducted semi-annually at SAC headquarters, when all flying safety officers are read in on the progress of the command's over-all safety program, new problems discussed and plans for the future delineated. At the 1950 summer session, Colonel Ellis outlined plans for the Flying Safety Year campaign. SAC's former Office of Public Information analyzed the objectives of the drive and prepared a Flying Safety Year brochure which provided detailed information on how to apply public information techniques to help solve the problem.

Most of the emphasis on accident prevention is aimed at the individual crewman because he, being human, represents the most fertile field for preventing accidents. Also, the natural urge for self-preservation is the strongest desire man possesses. However, other cause factors, such as mechanical failures, weather and ground facilities receive similar stress in what Colonel Ellis describes as "SAC's two-phase accident prevention program—the defensive and offensive phases." The defensive phase is carried out in the thorough investigations made of each accident and the recommendations that follow. The offense is concerned with testing and improving operational procedures and training methods and seeking improvements in equipment design and manufacture.

The fate of the "Lucky Lady II," the B-50 bomber that achieved fame for flying non-stop around the world in 1949, is an example of the defensive phase and also of the unpredictable in air safety. About a year after its famed flight, the "Lucky Lady" was being flown on a routine training mission when smoke was noted curling from an electrical panel in the crew compartment. While the aircraft commander headed the bomber back to Davis-Monthan AFB near Tucson for an emergency landing, the flight engineer checked the electrical system. He located an electrical short and the generators and main electrical system were turned off. The pilot sparingly used the radio, electrical flap and gear motors to prepare for the landing. Things looked good on the final. He thought he had it made. Then, suddenly, without warning, all four engines conked simultaneously. Minus power, the pilot had no alternative but to crash land short of the runway.

The "Lucky Lady" flew no more. But, when flying safety officers, maintenance personnel and manufacturer's representatives delved into the accident, they learned that whenever the battery voltage dropped below the halfway point, the main fuel tank shut off valves closed automatically. The engines had simply quit because of fuel starvation. That factor had not been designed into the aircraft—it was something that just happened and something which no one knew about until the "Lucky Lady II" crashed.

Since then, all similar B-50's have been modified with a different fuel shut-off valve to prevent a future accident of this nature.

An example of the offensive phase of SAC's safety program is a take-off and landing data card required for each take-off and landing made in four-engine bombers or transports. The information on this card provides the pilot with all the performance facts he requires for a normal or emergency take-off or landing.

Take-off data include: Per cent mean aerodynamic chord (MAC); gross weight; equivalent gross weight; torque pounds per square inch (PSI); brake horsepower (BHP) available; four-engine take-off distance; accelerate-stop distance; take-off decision and indicated airspeed (IAS); unstick speed; minimum climb-out speed; minimum flap retraction speed; best three-engine climb speed, and best four-engine climb speed.

Landing data: Gross weight; equivalent gross weight; torque PSI; BHP available; minimum stop distance; best three- and two-engine IAS and rate-of-climb with gear up flaps up, half flaps, and gear down full flaps and half flaps; minimum approach IAS and minimum flap retraction IAS.

The varying conditions—gross weight, field elevation, runway length and weather—under which SAC planes are operated all over the globe dictate the use of such performance data for each take-off and landing to assure maximum safety. For instance, a B-29's minimum approach speed varies 25 mph for landing weights from 90,000 to 140,000 pounds.

The take-off and landing data card has been a potent weapon in preventing take-off and emergency go-around accidents, especially the latter which have in the past resulted when pilots retracted flaps before sufficient airspeed was acquired.

Another SOP has virtually eliminated crashes resulting when flaps were retracted prematurely after take-off and the aircraft either settled or was flown inadvertently back into the ground. That requirement is that flaps are not retracted nor take-off power reduced until 500 feet terrain clearance is reached and a safe three-engine speed has been attained.

A ringing endorsement of SAC's safety program recently came from the Air Force's top man on safety, Maj. Gen. Victor E. Bertrandias, chief of the USAF's Directorate of Flight Safety Research at San Bernardino, Calif. In a letter to SAC's boss, he wrote:

"I find it difficult to select words of praise for your Flying Safety program and the added impetus you are giving accident prevention. . . . This is particularly noteworthy when you consider that the Secretary of the Air Force and the Chief of Staff make foremost mention, at every public function, to Congress and the people of the great importance of the mission of SAC. With all the problems you and your staff have in effecting a complete state of readiness to perform your mission at any hour, while at the same time being confronted with the introduction of new equipment, new organization and new people and the support required, I find it most praiseworthy that you find time to develop an outstanding flying safety program. . . . Your program, I think, is a pattern which I hope other commands in the Air Force will follow. . . . You, your staff, and the director of your flying safety program are to be highly commended."

Although the goal, literally, of each flying safety officer is to be so successful with his program that he will work himself out of a job—that goal is an acknowledged impossibility. Perennially it will be out of reach; for as long as men operate man-made aircraft, accidents will occur. For one thing, SAC men are today's pioneers in aviation. The urgency of its mission requires that they constantly seek and operate the newest and most advanced aircraft—equipment which, if time permitted, would be given additional testing before being placed in operation.

But, it is a calculated risk—a price this nation must pay for the security SAC is providing with its atomic mailed fist ready to lash out at the heart of an enemy at any point on the globe on a moment's notice.

Concerning air safety, SAC's boss has observed, "Accident rates never stand still; they either go up or down." And although SAC's rate is currently close to the bottom, there is no intention in the future of letting it go anywhere except down. States Colonel Ellis, "The rewards in lives, aircraft and money saved and increased combat potential are too great to do otherwise."

DITCHING procedure was emphasized in safety program. An amateur movie, "Private Dumbjohn," was filmed at MacDill, loaned to other stations. Here Lt. Reiser photographs "Dumbjohn"

Air Role of Finland

(*Continued from page 13*)

countries, Norway and Sweden have the role, albeit an onerous one, of northern protecting flank to Western Europe, while geographically situated at their back door is Finland which has a mutual assistance pact with the Soviet Union. Although Finland is virtually defenseless and, militarily, no longer a factor to be considered, this little country of less than four million people and rugged, forest-covered terrain, is being used by the Kremlin as cover for an attempt to puncture the Atlantic Pact; to deny North European bases to the West by forming a "neutral" Scandinavian alliance. The first step in this Soviet-dictated diplomatic campaign was taken recently by the Finnish Premier Urho Kekkonen when he launched a plan for a Scandinavian four-power neutrality pact, an object of which is to break Norway and Denmark's obligations to the Atlantic Pact.

Norway and Denmark have sought safety by collaborating with the Western allies within the structure of the Atlantic Pact, while Sweden has remained neutral, an attitude which paid off in World War II but which may well have been dictated by a fear that, had it participated in the Pact, Russia may have retaliated by occupying Finland, whose population has a large Swedish component. Denmark was originally reluctant to join the Western allies, expressing a preference for a defense alliance with Norway and Sweden, and Norway has received so many complaints from the Soviet Union concerning Norwegian participation in the Atlantic Pact, that the Kremlin thinks the country ready for neutrality and the time ripe to remove a potential air threat to Russia's northern communications.

Finland, the king pin in this new Soviet move, has tried hard to keep the Reds out of her hair without becoming another peoples' democracy, but she knows that in the event of an open clash in Europe between Russia and the West she will be incorporated in a Soviet *deployment belt* during the opening stages of the conflict, forming the springboard for a land attack on her Scandinavian neighbors and air assaults against both the United States and the major Western bastion in Europe, Britain.

Premier Kekkonen has claimed that *his* plan is to ensure peace under any circumstances, for, it was little more than 12 years ago that the Finns were making a valiant stand in the face of overwhelming Russian forces and thoroughly discountenancing the Reds in the process. Considering that any enemy of Russia was a friend of Finland, the Finns again fought the Russians, as allies of Germany, from the summer of 1941 until 1945, even though they were treated more as occupied people than as allies. Finally, ravaged by Nazis and Reds alike, the Finns were again defeated; they had suffered 100,000 dead; every ninth citizen had lost his home; every 16th man had been disabled, and every 17th woman was a war widow.

As a result of reparations to Russia and an influx of 45,000 refugees who had refused to remain in the areas of Finland ceded to Russia, the Finns embarked upon a very arduous period of postwar recovery. Under the terms of the Peace Treaty that she concluded with the United Kingdom and Russia on February 10, 1947, the strength of her armed forces was limited to 41,500 men. The Finnish Air Force, including the Naval Air Arm, was limited to 60 airplanes and a personnel not exceeding 3,000 men. Bombers or airplanes suitable for conversion for bombing missions and the developments of rockets or guided missiles was expressly forbidden. However, despite the knowledge that no effective resistance can be offered to an aggressor, Finland retains a token air force, within the limits of the Peace Treaty and, with reparations to Russia due to be paid off this year, development of military airplanes has begun, for the Finns, like their Scandinavian neighbors, are a very air-minded people, a characteristic illustrated by the fact that their small domestic airline network carried 43,000 passengers during 1950 alone.

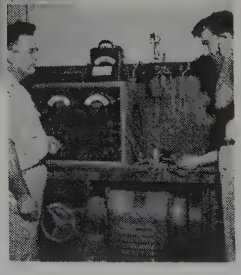
The Finnish Air Force today is commanded by Major General F. E. Helminen who is responsible to the Commander of the Defense Forces, General of Infantry A. Sihvo. The Air Force consists of only four squadrons; LeR-1, equipped with Messerschmitt Me-109G fighters and based at Pori airfield; LeR-2, also equipped with Me-109G fighters and based at Kuopio; LeR-3, a training unit equipped with a miscellany of types ranging from the nationally designed Pyry advanced training monoplane to the Viima II elementary trainer biplane and a vintage Junk-

(*Continued on page 42*)

Incomparable

a pretty girl

Our 4th of July firecracker girl is illustrating what not to do on the beach this month. The mere thought that such a comely lass might accidentally detonate herself fills us with anguish. Videlle Rux is a freshman at the University of Texas. She is 18, has brown eyes and blonde hair and likes to swim and play tennis. If you're baffled by the "73-88", ask a pilot pal its meaning. (No. 10 in a series of prettyDallas girls discovered and photographed especially for Southwest Airmotive).



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KARHU 48 is a cabin monoplane powered by 190-hp Lycoming engine. It is a four-place plane available as both a landplane and a seaplane (*above*). It is in production today in Finland

Air Role of Finland

(*Continued from page 41*)

ers W-34 crew trainer, based at Utti; and LeR-4 reconnaissance and liaison squadron equipped with a variety of obsolete airplanes of various nationalities and based at Jyvaskyla. A military flying school is situated at Kauhava.

Air Force During War

Although 12 years ago operations on the Finnish front were headline news, little has been written hitherto concerning the miscellany of out-dated airplanes with which the Finnish Air Force fought off Soviet Air Force elements and hit back at the Russians.

When Russia invaded Finland in the winter of '39-40, the Finnish Air Force comprised 95 airplanes, many of which were vintage types dating back to the early '20's. Gloster *Gladiator* fighter biplanes, Bristol *Blenheim* light bombers and Brewster F2A and Curtiss *Hawk* 75A fighters were acquired from Britain and the United States and, with a handful of Fokker D-21 fighters purchased from Holland, formed the main operational elements of the Finnish Air Force during 1940-41, most of the machines having arrived too late to take part in the initial Russo-Finnish campaign. Training airplanes were of national design, built by the *Valtion Lentokonetehdas* (State Aircraft Plant) at Tampere, and included the *Tuisku/T (Snow Owl)* two-seater advanced training biplane, the *Viima II (Breeze)* elementary training biplane, and the *Pyry (Thunderstorm)* advanced training monoplane, all of which are, incidentally, still to be seen in Finland today.

With the renewal of fighting between Finland and Russia, some modern Messerschmitt Me-109G-2 and G-6 fighters and Junkers Ju-88A-4 bombers were transferred from the *Luftwaffe* to Finnish combat elements, but the shortage of modern military airplanes became so acute that the Finns were forced to use a number of captured Russian machines which brought the total of operational airplanes *types* in Finnish service up to 34! ! ! For many of these airplanes spares were virtually unobtainable.

An instance of the maintenance problems that beset the Finnish High Command is given by the fact that no less than 12 different types of fighters were in front-line service with Finnish squadrons. These included the Fokker D-21, the Gloster *Gladiator*, the Curtiss Hawk 75A, the Brewster F2A, the Fiat G.50, the Morane 406C, a version of the latter airplane fitted with the captured Russian M-109 engine, the Hawker *Hurricane* II, the Polikarpov 1-15 and 1-15C, the LaGG-3, (the latter four types captured from the Russians) and, finally, the Messerschmitt M-109G-2 and G-6.

The situation was rapidly becoming disastrous with many of the aircraft grounded for lack of spares and other much-needed airplanes being 'cannibalized' in order to keep a few of their fellows in the air. It was, therefore, decided that the State Aircraft Plant, that had previously concentrated on the construction of trainers and Bristol *Blenheim* bombers, should switch production to fighters immediately. A prototype fighter had appeared in 1940, but owing to teething troubles and material shortages quantity production did not get under way until 1943.

This first all-Finnish fighter was known as the *Myrsky (Wind)* and was designed by Dip. Ing. E. Wegeluis. It was of mixed construction, the wing of wood and the fuselage of steel tube covered by plywood, and was powered by a 1,065-hp Pratt & Whitney R-1830 *Twin Wasp* radial. This gave the *Myrsky* a top speed of 329 mph and a cruising speed of 248 mph—adequate to combat Russian fighters that were being met on the Finnish front at that time—and the armament consisted of four Finnish Lkk/42 machine guns of 12.7mm mounted in the fuselage and firing through the prop disc. The first *Myrsky* suffered repeated structural failures at the wing attachment points, leading to a complete redesign and restressing of the wing, but the fault was not finally cured until the angle of incidence was changed and other modifications made. These troubles seriously delayed production as did delays in engine deliveries from Sweden (where the R-1830 was being built *without* license) and only 61 *Myrsky* fighters had been completed when production was stopped by the Allied Control Commission.

By 1944 it had become obvious to the Finns that the *Myrsky* was already out-dated and the development of a new fighter, the *Pyorremyrsky (Whirlwind)* powered by a 1,475-hp Daimler-Benz DB 605AC engine, design of which had begun in 1943, was speeded up. Like the *Myrsky*, the *Pyorremyrsky* was of mixed construction. Armament consisted of two 12.7-mm LKK/42 machine guns and one 20-mm MG 151 cannon, and top speed was 390 at 24,000 feet. However, tooling-up for the *Pyorremyrsky* had not been completed at Tampere when the war ended, and only the prototype was completed and flown.

Airplane Production Today

In order to meet Soviet reparation demands, the State Aircraft Plant was incorporated in the State Metal Works, and further work on aircraft was discontinued in

FINNISH AIR LINES is gradually expanding its network. It is operating schedules to Stockholm, Amsterdam, Copenhagen and Dusseldorf. In 1950, Finnish Air Lines carried 75,606 passengers

order to build railway wagons for the Soviet Government. But recently airplane development was begun again and the former State Aircraft Plant was incorporated in the *Valtion Metallitehtaat, Lentokonetehdas* (State Metal Works, Aircraft Division) which has three branches, with the Tampere plant as the central unit. The Linnavuori plant at Siuvo produces aircraft engines, and the Kuorevesi plant is used for airplane repair and maintenance.

The strict limitations on the size of the Finnish Air Force preclude the possibility of any substantial aircraft orders, but early last year the Tampere plant produced the prototype *Vihuri* fighter trainer which is now completing acceptance trials. The *Vihuri* is a tandem two-seater of all-metal construction powered by an 830-hp Bristol *Mercury* 8 radial which gives a top speed of 273 mph and a cruising speed of 217 mph. Service ceiling is 27,887 feet and diving speed (c.a.s.) is 404 mph. The Tampere plant is also developing the Tuuli high-wing monoplane for military liaison duties and touring.

An interesting little amphibian built at Tampere and designed by Torolf Eklund is the Eklund TE-1. Originally powered by an ancient 28p-h Poinsard engine which was first installed in a *Pou de Ciel* of 1935, the TE-1 is now powered by a 40-hp Continental A-40-5, in which form it is known as the TE-1A. The TE-1A is a single-seater amphibian with retractable landing gear and folding wings to facilitate transportation. Spanning only 24 feet 7 inches, the TE-1A has a top speed of 97 mph, cruises at 85 mph, and has an empty weight of 485 pounds. Further developments are the TE-1B single-seat flying-boat, the TE-1B-S single-seat flying-boat which may be equipped with fixed ski landing gear, and the TE-1B-G, single-seat flying-boat with wheel beaching gear only. A projected development is the TE-2 with a 65-hp Walter Mikron engine.

One of the few Finnish private airplane manufacturers is the *Veljekset Karhumaki O/Y*, which has a plant at Halli airfield. This company's first postwar product was the Karhu 48 cabin monoplane powered by a 190-hp Lycoming 0-435-A. A braced high-wing monoplane of welded steel-tube structure with fabric covering, the Karhu 48 is a four-seater, and both landplane and seaplane versions have been tested. In its landplane version, the maximum speed is 142 mph and the cruising speed is 115 mph. A developed version, the Karhu 48B, is at present under construction at Halli.

Like other Finnish aviation activities, Finnish commercial airlines were seriously affected by the war, but *Aero O/Y* (Finnish Air Lines) has gradually expanded its network during the past few years. Foreign services were resumed with schedules to Stockholm and later to Amsterdam, Copenhagen and Dusseldorf, and good internal services have been developed. During 1950, *Aero O/Y* flew 2,078,158 aircraft kilometers, carried 75,606 passengers, 295,629 kilos of freight and 189,526 kilos of mail—a commendable total considering that *Aero O/Y's* fleet consists of only eight Douglas DC-3's. *Aero O/Y* has an unduplicated route mileage of 2,860 miles. Seventy-three per cent of its shares are held by the Finnish government and the remainder by Finnish banking and shipping interests. The *Valjekset Karhumaki*, previously mentioned in connection with its airplane building activities, also operates a number of internal services with Lockheed *Lodestars* and de Havilland *Dragon Rapides*.

The Finns know that their position on Russia's border is precarious; the small percentage of Communists among them proved to be further reduced in the last elections, but it is not an internal *Coup d' etat* that they fear, but a Russian take-over on some pretext or other in order to scare Finland's neighbors into neutrality. The average Finn's attitude toward possible Russian aggression is perhaps best expressed by the Finnish airline pilot who recently said to the writer: "Four million Finns can do little against 180,000,000 Russians but the cost of occupying Finland and suppressing the tough Finns might give the Reds some very unpleasant surprises".

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BOEING B-52, eight-jet bomber, has a wing span of 185 feet. The wing's sweep back is clearly in evidence here in this nose-on photo. The big Air Force bomber is powered by eight Pratt & Whitney J-57 jet engines. Note out-rigger wheels on the wing tips

Armed for Altitude

(*Continued from page 15*)

level. Equipped with the latest in oxygen equipment, it permits training to be carried on under conditions similar to those encountered at 43,000 feet—the highest man can fly without pressurized cabins or equipment for oxygen pressure breathing.

The chamber is divided into two rooms which can be operated independently of each other. The smaller of the two rooms is called the lock, and during altitude runs it is kept 10,000 feet below the main chamber. Should one of the students encounter ear or sinus trouble during the ascent, the main chamber is lowered to the altitude of the lock and the student placed in it. He can then be lowered to sea level while the main chamber goes on up to complete the run. Above 20,000 feet a man can be raised or lowered 10,000 feet swiftly with very little discomfort.

Normally, it takes a crew of eight to operate the chamber: a lock operator and chamber operator, two inside observers, two outside observers, a recorder and a crew chief. The operators control the huge valves and switches that regulate the pressure, temperature and oxygen supply. The inside observers ride with the students and conduct the various experiments that illustrate the effects of high altitude during the run. The outside observers, peering through glass portholes in the chamber, keep a close watch on the students, and also the inside observers, for no one is immune to hypoxia. The recorder times the various experiments and keeps a record of the ascent. The crew chief keeps one eye on the pumps, oxygen tanks, and air conditioning equipment during the "flight." A flight surgeon also stands by for emergencies.

The crew is rotated daily from job to job. This is done so that no one man is required to go up more than twice per week. Contrary to most types of training which builds up resistance to the elements involved, constant decompression causes one to become highly susceptible to hypoxia. Every man can give one or more of the classroom lectures and all of them are highly skilled in all phases of the chamber operation.

On the day that I received my training, I was greeted by Maj. William T. Larkin of Fairlawn, N. J., aviation physiologist who heads the training unit at Wiesbaden. A military pilot in his own right, Maj. Larkin is very enthusiastic about the type of training conducted by his unit.

"We don't attempt to make aviation physiologists out of every pilot or crewman who passes through here," he told me. "We do, however, expect them to be able to detect signs of hypoxia in themselves and others and know what steps to take, when they leave here."

During the morning I listened to lectures on decompression sickness, the bends, chokes, and disturbances of the central nervous system. Like the deep sea diver, the high-altitude flyer suffers from the bends. This form of decompression sickness is brought on by the nitrogen in the blood escaping through the walls of the blood vessels and settling in the various joints and tissues. The bends are rarely fatal and usually have no ill aftereffects. In the case of the chokes, the nitrogen settles in the chest and lungs and the victim may smother if not lowered immediately to an altitude below 30,000 feet. If the nitrogen settles in the brain, the central nervous system is disturbed, often causing complete or partial paralysis of one or more members of the body. This, like the chokes, can be fatal or have such lasting ill effects as paralysis of portions of the body.

"However," grinned S/Sgt. Howard L. Parrett of Los Angeles, Calif. (formerly Ft Worth, Tex.) as he noticed me starting to squirm, "don't get too worried about those sicknesses. They only occur at altitudes above 30,000 feet and then only if you are exposed for a long time."

I also listened to lectures on the use of oxygen equipment, and how to get out of a plane at high altitudes. I learned that it is not healthy to leap from a disabled plane at 30,000 feet and immediately pull the rip cord even with a "bail out" oxygen bottle strapped to me.

S/Sgt. Archie Simmons of Enid, Okla., and Magnolia, Miss., was very emphatic on that point. "In the first place," he said, "the opening shock at 30,000 feet is far greater than at an altitude of around 15,000 feet or even lower. The chances are you would rip your 'chute or jar your oxygen supply loose. The thing to do is to get out of the plane and then utilize the advantage that a free fall of a few thousand feet will give you. Your forward speed will be greatly reduced and you will get out of the oxygen-thin air a lot faster. Never, if you can avoid it, jump without oxygen with you."

Following the four hours of lectures and training films we were fitted with helmets and oxygen masks. Once the mask was fitted to my face, Sgt. Simmons told me to shut my eyes. He then closed the oxygen tube and at the same time passed a cotton swab around the edge of the mask. "Smell anything?" I shook my head. He then freed the tube and I was immediately overpowered by a strong odor of oil of wintergreen. "If you could have smelled that before, your mask would have been leaking," he explained.

"Now you all are ready to go into the decompression chamber," T/Sgt. Herbert G. Frogge announced as he finished inspecting our masks. "The three of you who have volunteered to help us with the demonstrations of hypoxia will take seats one, two, and three. The rest of you seat yourselves around the room at any of the positons with an oxygen inlet and intercom connections. You will note that the headsets and mikes are built into your helmets and masks. All you will have to do is plug into the connections."

We trooped into the chamber and seated ourselves as instructed. As we hooked up our equipment we began to hear the voice of the inside observer, Sgt. Eugene Henshaw of Belleville, Ill., who was seated behind a small table at the end of the chamber.

"After you have checked your masks to see that they are working properly, remove them but do not unfasten them completely from your helmets. The chamber is going to be raised to 5,000 feet and then lowered rather rapidly to sea level. If you have ear pains tell us immediately and we will help you to clear them. Any one who suffers severe pains during the descent will not be required to make the run."

As he finished speaking we heard the heavy steel door bang shut and another voice came over the intercom, that of Sgt. Dallas D. Bybee, Righy, Idaho, who was operating the chamber controls. "Chamber now ascending at the rate of 3,000 feet per minute," he said.

SIZE of the altitude training chamber may be judged from this view of equipment needed to unload it from flat car. Chamber is divided into two rooms; the lock and the main chamber

Sgt. Henshaw called our attention to a small balloon which was attached to an empty bottle, sitting on the floor in the center of the chamber.

"Watch that balloon from time to time during the flight. By its reactions you will know how the decreased pressure is affecting gases that may be in your stomach and bowels.

"Do not hesitate to unfasten your belts if you feel any discomfort."

"Chamber leveling at 5,000 feet," came the voice of Sgt. Bybee.

A slight popping of the ears told me that the chamber had started down again a few seconds later. We reached sea level with no one complaining of ear or sinus trouble, and started up again.

During the ascent, Sgt. Herbert L. Small of Lubec, Maine, who was to be the number one volunteer was told to practice the first demonstration. It consisted of moving a number of pegs with two color tops from one side of the board to the other, reversing the colors as he did so.

"Chamber leveling at 18,000," came the voice of Sgt. Bybee again through the intercom system.

At this point Sgt. Small was told to start the demonstration again. He was timed on this attempt and his time reported at 41 seconds.

"The rest of you put on your masks," Sgt. Henshaw instructed. "Sgt. Small, you will leave your mask off and begin doing the exercise again as soon as the chamber starts up, and keep on doing it as long as you can."

"Chamber passing through 20,000," the operator announced.

At this point Sgt. Small had nearly completed the exercise but it was evident that he was slowing down.

"Time 52 seconds," the recorder, Cpl. Raymond Gray, of Springfield, Ohio, announced.

"Leveling at 25,000," announced Bybee.

"Fine," Small replied.

"O.K., now I want the rest of you to disconnect your masks and leave them off until you feel a definite symptom of hypoxia. Sgt. Frogge will talk to you from outside the chamber about the symptoms you may expect.

Sgt. Simmons, (the inside lock observer) and I will keep an eye on you," Sgt. Henshaw told us. I disconnected my mask as Sgt. Frogge began to talk.

"This may affect you in various ways," he began. "Some of you will become belligerent, others will have a feeling of exuberance, some of you may have an itching skin and may even break out in a rash. All of you will note a lessening of your vision. Some of you may become sad. One of the more common of the reactions will be a feeling of distaste for authority. I don't want you to make an endurance contest of this. Just leave your mask disconnected long enough to feel a symptom that you will readily recognize."

I don't know how long he kept on talking and I didn't care. I was feeling extremely well just waiting for a symptom to appear.

INSTRUCTOR Sgt. Howard Parreet *(right)* guides a training student through a coordination test at 25,000 feet. Student must move blocks from one side of board to other, reverse tops

"Sgt. Small, begin the exercise again," Sgt. Henshaw instructed. He did. But his coordination was deteriorating so rapidly that it was almost impossible for him to get the pegs into the holes. He gave up trying to reverse the colors entirely. He did complete the exercise before becoming unconscious, however. During the last part of it, his hands were jumping up and down as if they were hung from the ceiling on coiled springs. His time was one minute and 56 seconds. After a few whiffs of oxygen he was completely revived and began doing the exercise again.

"You will note that when revived, he automatically started doing the exercise again," Sgt. Henshaw pointed out. "We believe that a good many pilots have been saved when they became unconscious from hypoxia by this fact. As they fell out of control into the denser air below 10,000 feet they were revived and automatically began flying again. How do you feel now, Sgt. Small?

Had I been aware of it I was experiencing one of the most common of symptoms. I had already reached the point where I was in danger. I also remember being very resentful of Sgt. Simmons who kept saying "Number eight, connect your mask." I knew I was Number eight but I didn't think it was any of his business whether my mask was connected or not. I remember that I wanted to sock him when he started fumbling with the hose of my oxygen mask, but it was too much trouble. This is another dangerous symptom. Suddenly I was wide-awake and not mad at anyone. Simmons had connected my mask.

I had been on the verge of unconsciousness. Sgt. Simmons had noticed that my finger nails were turning blue, one of the first signs of hypoxia, and had started telling me to hook up my mask. I learned one thing for sure—if I ever start feeling too good in an airplane again, I will hunt for oxygen on the double. I'm one who's learned!

"Now that everyone is back on oxygen again, adjust your regulators to the 'safety position' and we will go on up," Sgt. Henshaw advised.

As we adjusted our masks the lock door was closed and we started up. I noticed that I had to use an entirely different set of breathing tactics with the mask at the new position. Oxygen was being forced into my lungs under pressure, so it was no problem to inhale. Exhaling against the pressure was a different story. It took a definite effort on my part to force the air out of my lungs. Sort of like breathing with your mouth open facing a strong wind.

Other than the reverse breathing and a definite fullness around the waistline I felt little different as the chamber climbed to 35,000 feet.

At 35,000 we again leveled off and the Number two volunteer was disconnected from his oxygen supply and told to start writing his name and serial number. He wrote it about three times and then started scribbling all over the paper. Revived by a few breaths of oxygen, he resumed writing normally again. Once more he was taken off oxygen and told to start subtracting three from 100 in a descending scale, *i.e.*, 97, 94, etc. He got to 94 and then made a few ineffective movements with his pencil. He looked up and saw the rest of us smiling, and he threw the pencil away in a burst of rage. Again he was put back on oxygen, recovered immediately and began looking for the pencil.

The Number three volunteer, Sgt. Robert E. Dudly of Glassport, Penna., was disconnected and told to hold his arms straight out in front of him and to go through various maneuvers of flying. He tilted his hands to the right and left a couple of times in simulated banks, and then froze with his arms rigidly in front of him. He could neither move them up nor down or in any direction. He was placed back on oxygen and resumed his simulated flying immediately.

This concluded the demonstration and we started down. Sgt. Frogge took over the mike outside the chamber and began talking to us on the way down.

"It might be well to quote a few figures on your life expectancy without oxygen at altitudes above 35,000 feet," he began. "At 35,000 feet unconsciousness comes in approximately one minute. At 40,000 feet, unconsciousness comes between 15 to 30 seconds and death at three to four minutes. At 50,000 feet, unconsciousness comes in 10 to 20 seconds, and death in one to two minutes. At 63,000 feet death comes almost instantly. It is interesting to note that a coroner examining a corpse that had expired at 63,000 feet would render the verdict of 'death by drowning'. Technically, he would be right. At that altitude there is nothing in the lungs but water, because the water vapor that is always present in the lungs has expanded to fill them completely, forcing all the various gases out."

By this time we were almost down, having descended to 10,000 feet at the rate of 2,000 feet per minute. From there on we descended much slower so as not to injure the ear drums. One of the group had a little trouble so we leveled off at 10,000 feet until Sgt. Simmons could help him clear his ears.

The rest of the trip down was uneventful. As the chamber door swung open at sea-

(*Continued on page 46*)

Armed for Altitude

(*Continued from page 45*)

level pressure we were told to go outside and take a smoke while the chamber was cleared of everything that was not fastened down. The next demonstration was to be that of "explosive decompression."

"We are going to place you all in the lock which will be raised to an altitude of 10,000 feet," Major Larkin said. "You will not be required to wear your mask, but you must have it immediately available. The chamber will be raised to 35,000 feet and then the membrane of X-ray film which you see in the bottom porthole of the lock door will be broken. The effect will be the same as if you were in a pressurized cabin which has been punctured by shell fire. You will rise from 10,000 to 25,000 feet almost instantly. Since this operation takes but a few minutes, we will use 'walk-around' oxygen bottles instead of the permanent oxygen stations. When you go inside the lock, hook your mask connecting tube to a bottle, but don't hook up your mask until after the explosion takes place."

We went in and the lock started up. The chamber with no one inside went up much faster. In just a few minutes, Sgt. Simmons who had been listening on the intercom walked over to the door between the lock and the chamber and picked up a sharp steel rod.

"Get set," he warned, and then punctured the membrane.

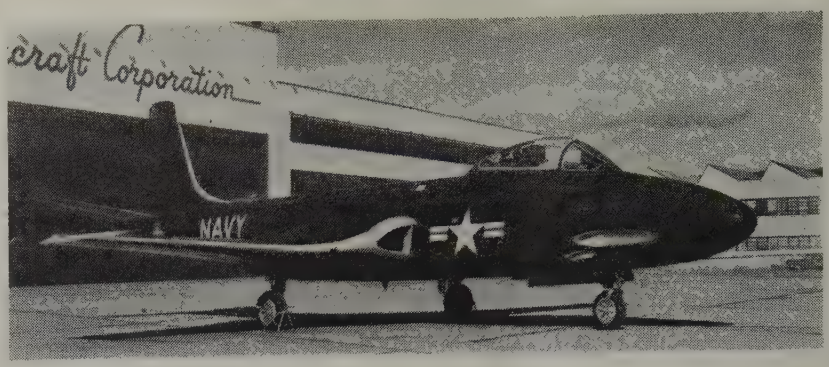
I was conscious of a loud noise and then the feeling that all the air had been sucked from my lungs, as indeed it had. I gasped for a moment and then discovered I was breathing normally again.

"You are now at 25,000 feet," Sgt. Simmons announced through the fog that had filled the room immediately after the explosion. "Put your masks on and we will go into the chamber and sit down. Plug into the intercom connections. Also unhook your oxygen bottles and hook up to the permanent connections."

We carried out his instructions and soon he began talking to us on the intercom. "This little bottle of oxygen may save your lives more ways than one," he said picking up one of the walk-around bottles. "There have been several cases where men who have been trapped in a submerged plane in the ocean, have saved their lives by simply hooking up to an oxygen bottle. The two or three minutes of breathing that the bottle afforded them gave them time enough to escape from the plane. Never move from place to place in a plane at high altitudes without having one handy. If you are going above 20,000 feet, always check to be sure it is full when you enter the plane.

Once again at sea level I removed my mask and prepared to leave the training center. I had obtained a new respect for an element that I had been utilizing since the first breath that I had ever drawn.

There is an old saying "You never miss the water until the well goes dry," which to my way of thinging goes double for oxygen. From now on, I am going to check the oxygen supply on any plane I enter which is capable of going above 20,000 feet. Like a parachute—it is better to have it and not need it than to need it and not have it.



BANSHEE F2H-3 is latest of the F2H line. It has a longer fuselage and carries greatly improved radar for all-weather combat operations; has increased range

Reverse Current Relays

(*Continued from page 31*)

initial contact pressure. The contacts are arranged so that they close before the sealed position of the armature assembly is reached. The remainder of the travel is wear allowance.

The movable contact is fastened to the armature assembly by means of a spring in such a manner that force is required to separate them. This force is the initial contact pressure of the relay and the performance of the contacts depend upon its value.

The coil must have the required number of ampere turns necessary to produce the pull on which it is to operate on the lowest voltage specified. The minimum open-circuit voltage in 28-volt systems is approximately 18 volts and, therefore, the pick-up voltage must not exceed this value when the final operating temperature of the coil is reached. The temperature rise of the coil has a limit of approximately 70° from an ambient temperature of approximately 25°.

The maximum voltage encountered in present-day aircraft systems is 28.5 volts. The coil must not exceed the specified temperature rise when this voltage is applied. These factors fix the radiating area and the resistance of the coil.

Intermittent duty contactors and also contactors which are not energized for long periods of time and do not attain the final specified temperature are designed for part-time duty only. The advantages of these contactors are the facts that the coils may be reduced in size or greater magnetic strength may be obtained from coils the same size as the continous duty coils, providing the special conditions of applications are met.

The pivoted armature-type relay or switch consists of a U-shaped magnet having the coil mounted on one leg and using the other leg as the magnetic-return path. It also utilizes the one leg as a support for the armature pivot. The armature lever may be extended in both directions and center balanced, reducing shock and excessive vibration. The contacts may be molded to either end, opening or closing when the magnet is energized. The travel of the armature is again limited by the sealing of the armature assembly against the core face. The coils of this assembly are very readily replaced. Spring tension takes up the wear allowance automatically in most magnetic assemblies but in some cases the flexibility of the parts of the assembly accomplishes this. However, this type arrangement requires much more attention because of wear and is used only when the amount of current handled and the wear is at a minimum.

The iron-clad solenoid magnet is also used in aircraft installations. The armature is a plunger located in the center of the coil and seating against the stationary core. The shell of the coil is the magnetic-return path and also seals and protects the unit. The stationary contacts are mounted on the end of the coil and the moving contacts travel in a straight line for engagement with the stationary contacts.

The part-time or intermittent-duty coils of a relay can be protected and adapted for continuous duty by the insertion of a resistor in the circuit of the relay. This resistor is placed in series with the coil after the main contactors have closed. An auxillary set of contacts is used to place the resistor in the line and the resistor may be additional turns of the coil itself. The auxillary contacts are set to close after the main contacts and the resistance value and pole faces are set to keep the magnetic strength greater at all points than the spring tension. This is done to prevent chattering of the relay or switch. The advantages of using smaller coils in this type construction may be completely lost because of the addition of the auxiliary contacts and greater difficulties incurred by the finer adjustments demanded by the smaller switches.

The main factor in discarding this type generator-control relay was that as the generator came up in speed the pick-up voltage would be reached and the contacts would close. Immediately upon closing, the relay would draw a sufficient reverse current to open again. This condition existed as long as the generator operated at or near pick-up voltage, hence chatter occurred. If the generator was connected in parallel and its regulator set low and the system load was light, this condition would exist for extended periods of time, thus shortening the service life of the relay and wearing it out.

The principal function of a generator-control relay is to connect the d-c generator to the bus whenever the generator is able to furnish power to the bus and to disconnect the generator from the bus whenever the generator draws reverse current of a predetermined value. With these principals in mind the industry's engineers developed the pres-

ent-day differential and reverse-current relay.

The principal feature of the differential and reverse-current relay is; a toggle-type paddle on which are wound a differential voltage coil and a reverse current coil (see Figure 2). The toggle-type paddle has two contacts molded to it which make the electrical contact with the magnetic frame member whenever the differential voltage coil is energized, completing the electrical circuit. Connected in the circuit in series with the differential-voltage coil is a polarized pilot relay. This pilot relay protects the differential-voltage coil from large differential voltages and operates the paralleling relay.

The differential reverse-current relay controls the aircraft line switch connected between the generator and the positive bus. Closing of the relay is accomplished through the combined operation of the polarized pilot relay and the differential voltage winding. As the generator increases in speed the output voltage increases. When the voltage across the shunt winding of the pilot relay reaches a predetermined value of approximately 22 volts, the relay arm which normally rests against the lower contacts, breaks away and moves toward the upper set of contacts. Upon closing with the upper contacts, the previously shorted paralleling relay is closed. This relay connects the generator to one end of the differential winding. In order to protect the pilot relay, a resistor is placed in the line between the lower contacts of the pilot relay and ground, to limit the current flow. The generator is now connected to one end of the differential voltage coil while the other end is permanently connected to the bus. When the generator voltage exceeds the bus voltage by 0.5 volts, the 0.5 volt differential is impressed on the differential voltage coil and sufficient current flows in the proper direction causing the relay to close. Should there be no battery or other generator on the bus, but nevertheless some other return path such as a connected load, the bus voltage will be zero and the differential and reverse-current relay will close immediately upon closing of the pilot relay.

With the closing of the differential and reverse-current relay, the circuit is completed to the coil of the main line contactor, which then closes and connects the generator to the bus. The differential voltage coil will have no voltage impressed upon it when the generator and the bus voltages are equal, but the contacts will remain closed until the toggle-type paddle is deliberately moved by one of its energizing coils in the proper direction. The reverse-current coil also aids in sealing this relay tight.

The other winding on the differential and reverse current relay is the reverse-current coil. This coil is connected in parallel with the series field of the generator and senses load current. When the generator is delivering current to the bus, the force of this winding tends to close the contacts all the tighter, but if the generator should drop off in speed or stop, such as would happen if the engine is shut down, the generator starts to draw reverse current from the bus, and the current in this winding is reversed. When the reverse current reaches a predetermined setting, usually between 16 and 30 amperes, the winding causes the relay to return to the open position, interrupting the coil circuit of the line switch and disconnecting the generator from the bus.

As the generator slows down, the voltage continues to drop. When it reaches approximately 12 volts, the pilot relay opens, introducing a high resistance in the differential coil circuit and shorting out the coil of the paralleling relay and opening the contacts.

Should the generator be taken off the bus manually instead of automatically by reverse current, the differential and reverse-current relay will remain in the closed position, since it is a toggle-type relay. This will also occur when the generator is stopped while there is no other source of voltage to the bus. Another possibility is that the relay may be accidently closed by hand while the generator is at rest.

If at this time, the generator polarity is reversed before it is started up again, (this could be done by the use of an ohmmeter on the field or by changing the generator, etc.), and with the differential relay in the closed position, the line switch would close as soon as the generator voltage reaches the line switch closing voltage. This would connect a generator of reversed polarity to the bus.

If the bus were energized at this time, the resultant current flow would be so great that the contactor would be completely destroyed and much more severe damage may result. Obviously, it is therefore important to keep the reversed polarity generator from going on the bus for an instant.

In the case just described, there are certain units now being manufactured in which the differential relay is opened by its own differential coil being energized, through a strong resistor, by the reversed voltage generated by the improperly polarized generator. The relay opens at a voltage far below the main contactors closing voltage, thereby protecting that unit by not allowing it to close at all. This will keep the incorrectly polarized generator of the bus until it is replaced with a correctly polarized generator, or its own field is flashed, correcting the polarity of the field coils.

With the increased responsibility of today's aircraft electrical systems, in the operation of its accessories, instruments and actuators, the industry's engineers are continuing research in the realm of still higher voltage d-c electrical systems. Experiments on the 115-volt d-c electrical system are being conducted every day. It has been stated that the 115-volt direct current electrical system is the lightest and most practical of all proposed electrical systems for aircraft, both medium and large. And the popular belief that the 115-volt system was unsatisfactory at high altitude has been refuted. However, this is but one step forward on the long road to proving its satisfactory use and its general acceptance in the aircraft industry.

Great strides are being made in reaching this goal and the development and refinement of the necessary generator control equipment for the higher voltage d-c electrical systems is continuing, in order that we may soon have these installations in our future giants of the sky.

But let us not forget, the reliability of any aircraft system is a product of engineering experience gained through years of labor and continual refinement. Therefore, any higher voltage systems employing main-engine driven, parallel-operated generators cannot be adapted to our program of greater safety in the air until they have been proved to provide at least the same degree of safety as our present day 30-volt low-voltage system.

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Nautical Miles

(*Continued from page 25*)

operations by both the military and their civilian contract carriers. In the course of that expansion, the Navy continued its traditional use of the nautical mile, while the other air arms, although retaining the statute mile as the basic unit, used the nautical mile for missions over large bodies of water, because of its superiority for navigation. (One nautical mile is exactly the length of one minute of longitude, or 1/21,600 of a great circle of the earth.)

Use of two units of measurement became an increasingly serious problem for the military, until finally, in 1946, the Air Force decided to put all its operations, overseas and domestic, on a nautical-mile basis. It began the change-over by equipping all aircraft whose prototype was developed after the 1946 decision with airspeed indicators reading in knots, and in conformity with government-wide policy, issued an operational regulation setting July 1, 1952, as the date for the full change-over to knots and nautical miles.

Before this final step, however, the civilian aspects of the problem made themselves felt. When CAA and other agencies started to work on the common civil-military airways system outlined in the 1948 report of RTCA Special Committee 31 (and demanded by the Congress as a condition of providing funds for new navigational aids), it became apparent that one unit of measurement would be necessary.

How could Distance Measuring Equipment (DME), an essential part of such a system, be developed on both a nautical and statute-mile basis without serious complications? And how could an automatic traffic control system be worked out if reports made in two different units had to be fed into electronic computers?

Faced with this dilemma, the Air Navigation Development Board presented the problem to the government's Air Coordinating Committee. After a careful review of all factors, the ACC decided early in 1950 that nautical miles and knots should be the single civil-military standard used in air navigation for measuring distance and speed. Following a survey of the industry, CAA in July 1950 set July 1, 1952, as a date for the change-over which would allow ample time for preparation.

Late this past winter, the ACC, at the request of one industry group, again reviewed the proposed change, and found its 1950 reasoning even more valid in light of 1952 conditions.

The original decision was made before Korea, in the light of the following factors:

(1) Ultimately one of the principal users of the airways, the military, will be using the nautical mile as the basic navigational unit, which would result in two distance units in equal use on the airways.

(2) To operate safely as well as efficiently, a common airway system must use the same basic unit of measurement.

(3) For proper and orderly development of the rather complicated components of the common system, the establishment of a single uniform distance unit was essential.

Having established the need for a change to one system of measurement or other other, the only question was, "Who should make the change?"

This was a tough one to answer, and the CAA was not eager for the choice to fall on civil aviation, knowing that the bulk of the change-over work would fall on us. It was recognized, however, that ability to navigate over the globe on short notice had become a permanent responsibility of military aviation, and a major part of its basic mission.

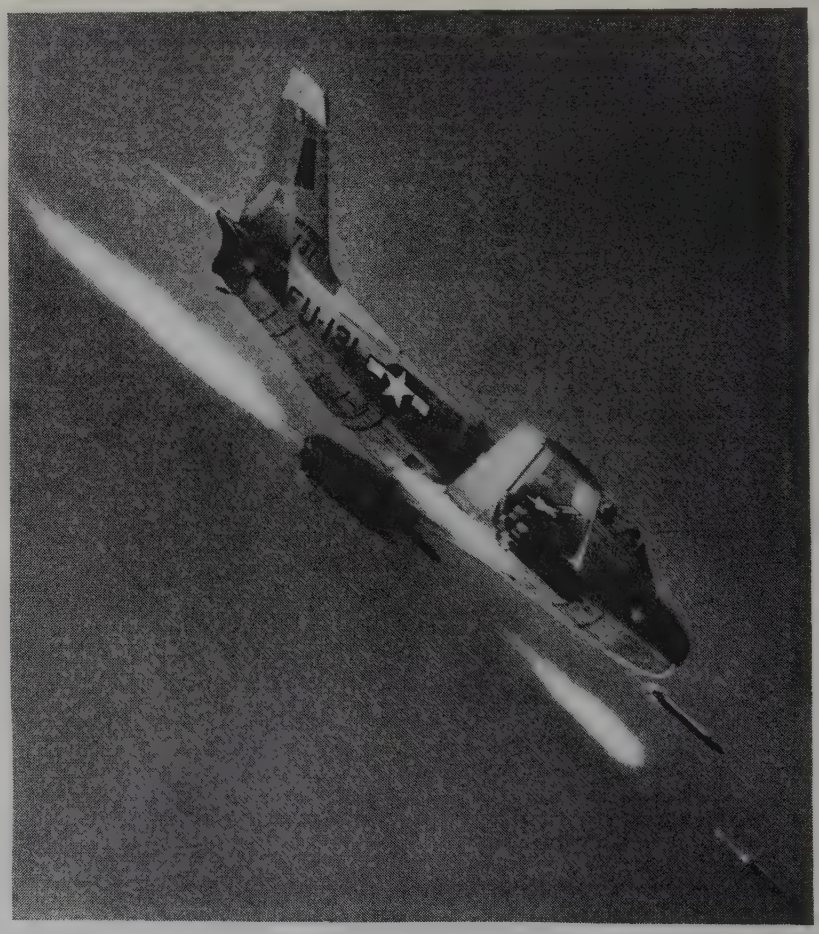
In the interest of national security, therefore, the Air Coordinating Committee decided that civil aviation would make the change.

Since that time, we have seen aggression in Korea make necessary an expansion of military aviation that still is under way. In the first eight months of 1951, the military accounted for 53 per cent of all communications contacts with CAA ground facilities. The figure undoubtedly will increase as the Air Force activates new wings.

If I have not already made it plain, let me underscore the fact that we are using nautical miles for the good of the United States, and not because of any international commitments. The United States recommended and accepted the nautical mile as the International Civil Aviation Organization standard for international operations, because of its superiority for over-water navigation, but did not attempt to put it into effect domestically until compelling reasons of national security made such a step desirable. As a matter of fact, a majority of foreign countries uses the nautical mile for navigation in preference to the kilometer which is their standard everyday measure of distance.

We have made similar changes in the past. Many of us, being human, grumbled at first, gradually got used to them, and finally wondered how we ever were able to operate otherwise. The 24-hour clock, adopted by civil aviation in 1948, is a case in point.

I am convinced that in a short time we all will be using the nautical mile in aviation almost automatically. CAA looks to the executive pilots to set the pace in taking this progressive step.



Sabre's Keen Edge

The Air Force's Number 1 jet fighter, the North American F-86 *Sabre*, carries a lethal load of HVAR rockets. Pictured here is a *Sabre* launching its 5-inch rockets at a target range at Nellis AFB. The *Sabre's* rockets, 16 of them, are carried externally on the wings. The jet fighter can also carry two 1,000 pound bombs or a combination of bombs and rockets. Six .50-cal machine guns are in the nose. The F-86 is powered by a GE J-47 of 5200 pounds thrust and it has a top speed "over 650 mph." At the present time the F-86 E and 'D are in production. The 'D is an interceptor designed for quick climb.

Aircraft Identification

(*Continued from page 23*)

wing, and the clean, angular tail assembly has a sweep angle of 35° on all leading edges. A noticeable fillet runs from the fin along the top of the rear fuselage.

In addition to being used by the USAF, the F-86E *Sabre* serves with the fighter squadrons of the Royal Canadian Air Force. Five-hundred Canadian-built *Sabres* are to be supplied to the Royal Air Force, and the Royal Australian Air Force will shortly begin to take delivery of *Sabres* built in Australian plants. Thus, the rugged North American-designed *Sabre* is likely to form the vanguard of many air forces' fighter strength for some years to come.

Data—Span: 37 ft. 1 in. Length: 37 ft. 6 in. Height: 14 ft. Power: One General Electric J-47-GE-13 axial-flow gas turbine. Armament: Six .50-cal guns in nose.

The little MiG-15 fighter, whose appearance over the Korean battle areas caused some drastic revision of ideas on Soviet combat-airplane design potential, can be described best as a winged stove-pipe dominated by proportionately the largest vertical tail surfaces of any airplane flying today. Indeed, the tail-consciousness of the MiG-15 makes it one of the few airplanes aflight which can legitimately be remembered by a single outstanding feature and not by a general over-all pattern.

The wing, which is mounted in full-mid position and has a 37° sweep at the leading edge, is of broader chord than that of the *Sabre* and is mounted further aft in relation to the fuselage length. Four chord-wise airflow fences stretch from the leading edge of the MiG's upper wing almost to the trailing edge of the upper wing, presumably to solve inadequate aileron power problems caused by the span-wise flow.

The circular-section fuselage is sawed off at both ends and cut back under the tail unit to reduce jet-pipe length. This has the effect of giving a heavy, lumpy aerial shape from any angle. However, the most useful recognition feature of the MiG-15 is undoubtedly the size of its vertical tail surfaces. These are almost half as long as the fuselage from leading edge root to trailing tip and carrying the diminutive tailplane toward their tip. This fin-rudder-tailplane combination combine in an extraordinary visual effect in which the tailplane looks detached from the rest of the airplane or as if it is being towed along behind. This effect is noticeable from almost any angle and gives the airplane its singular character.

The MiG-15 is the most widely used of Soviet jet fighters. Apart from the many Russian squadrons employing this fighter, the type is used by Czech, Polish and Sine-Communist squadrons, and is being produced in Czechoslovakia.

Data—Approximate span: 33 ft. Approximate length: 33 ft. Approximate height: 13 ft. Power: One centrifugal-type turbojet. Armament: One 30-mm or 37-mm cannon mounted semi-externally on portside and two 20-mm or 12.7-mm guns, also semi-externally mounted, under the nose of the MiG and to starboard.

The Dassault MD 452 *Mystere* is one of the few French postwar military prototypes to have attained production status. It has been flown and highly approved by USAF Major Charles Yeager and has shown up very well in mock combat with the F-86E *Sabre*. Like its USAF counterpart, the *Mystere* is a low-wing monoplane but its wing is of lower aspect ratio with less sweep (approximately 30° at leading edge) and blunder tips. The wing is mounted well amidships on the circular-section fuselage, giving the *Mystere* a nose-conscious appearance in the air. The fuselage itself is a nondescript fat pipe, the pilot sitting well ahead of the wing leading edge, the whole being surmounted by a squat tail assembly. The fin and rudder are of broad chord, slightly swept, and the tailplane is set about one third of the way up the vertical surfaces. All tail surfaces are of square-cut appearance.

JET LOOK—Visored helmet *(left)* was designed by J. Margwarth of Lockheed. Visor filters out ultra-violet rays at high altitude. Old style is worn by the pilot on the right

The *Mystere* is actually a developed version of the MD 450 *Ouragan* which it is to supplant on the production lines. The prototype *Mystere* is powered by a 5,000 pounds thrust Hispano-built *Nene* 102 centrifugal-type unit; five pre-production models have the 6,277 pounds thrust Hispano-built *Tay* centrifugal-type unit, and six pre-production airplanes have the 6,173 pounds thrust ATAR 101C axial-flow unit. Production airplanes will probably standardize on one or other of the latter units.

Data—Approximate span: 40 feet. Approximate length: 36 feet. Approximate height: 12 ft. 6 ins. Armament: (Prototype) Four 20-mm guns mounted in nose, (production) 30-mm guns.

The second Kremliner featured this month is the Lavochkin La-17 which is unusual among modern fighters in having its wing (swept 32° at leading edge) mounted in shoulder position. It is larger than the MiG-15 which suggests that it is intended for longer range operations than its purely interceptor-type stablemate. The wing is of almost parallel chord and of higher aspect ratio than those of its contemporaries, and four chordwise airflow fences are mounted on the wing upper surfaces. Like the other Russian fighter, the La-17 is tail conscious, although not quite to such a marked degree, and the broad swept fin and rudder combination carries the tailplane near to its tip. An unusual feature of the rear fuselage is the long ventral fin which appears to have started life as a tail bumper and then extended as an afterthought. The all-round vision pilot's canopy is mounted ahead of the wing leading edge.

Reports of the La-17's appearance over Korea and Eastern Germany are unsubstantiated at the time of writing, but there can be little doubt that this fighter would be in the forefront of any fighting that might take place in Europe.

Data—Approximate span: 40 ft. Approximate length: 37 ft. Approximate height: 14 ft. Power: One turbojet of unknown type. Armament: Two 20-mm or 30-mm guns in fuselage nose, one either side of nosewheel housing.

Briefly, the main differences between the Western and Soviet fighters for identification purposes are that the former are both low-wing monoplanes with fairly low-set tailplanes, whereas the latter are mid- and shoulder-wing monoplanes with their tailplanes carried near to the tips of their fin and rudder assemblies.

Dilbert

(*Continued from page 37*)

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What is Your Procedure—When your friends wish you "Happy Landings," it isn't an idle gesture. Did you know that approximately a third of all aircraft accidents occur during landing? Not emergency landings, either; just the normal, run-of-the-mill kind. Since pilots hold the responsibility bag in most of these cases, it behooves us to make sure that we are not making some of the asinine little errors involved in this large category of *unnecessary* accidents.

Did I say "little?" There is no such thing as a "little" mistake in aviation.

Analysis shows that most of these landing accidents could be prevented if all pilots made it a rule to include the following in their landing procedure:

1. Use landing check-off list. Of course—but you'd be surprised how often this is neglected.

2. Know the traffic rules of any airport at which you intend to land.

3. When approaching an unfamiliar field, spot obstructions and watch for holes, ditches, high weeds and construction work. On any field, be sure your landing area is clear of aircraft and other hazards.

4. Keep a sharp lookout for other aircraft.

5. Check your safety belt and shoulder harness.

6. Clear your engine frequently during glide, and use heat control as necessary, to insure you will have power available if you need it. Also, prop in low pitch.

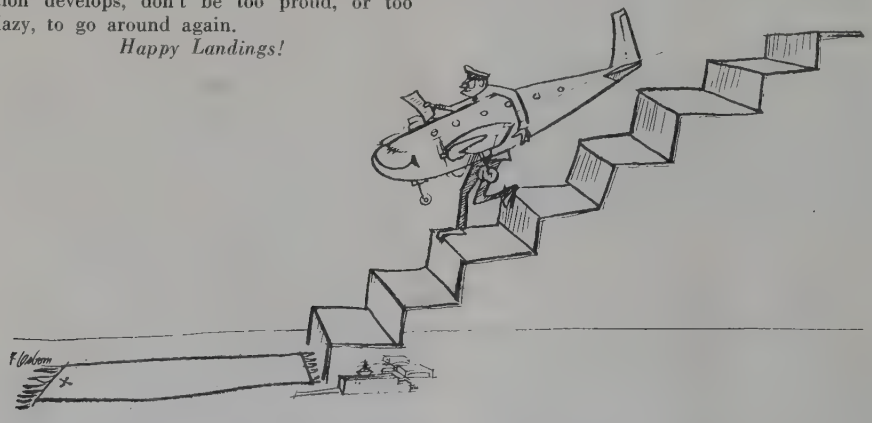
7. Be sure of the wind direction. Land directly into it where possible. Practice crosswind landings under favorable conditions on a familiar airport.

8. Watch your airspeed. Avoid too much, to prevent overshooting. Be sure you have enough, so you won't have to s-t-r-e t-c-h your glide.

9. Don't attempt to turn during a fast roll. And don't expect your brakes to stop you in five or 10 feet.

10. Never commit yourself to a landing too far ahead of time. If a dangerous situation develops, don't be too proud, or too lazy, to go around again.

Happy Landings!



Curb That Instinct—Dilbert's take-off the other day ran true to form. Knowing some of his buddies were watching, he held his plane on the deck to build up speed, then pulled her up in a sharp climb. That would show 'em!

It did, too. At about 200 feet his engine conked out. Instinctively, he leveled off and made a sharp turn toward the field. The tree he spun into was a soft maple, but not soft enough. When he awoke, he was pained to learn he was a patient in the hospital.

When his friends were allowed to visit him, Dilbert readily admitted that the zooming take-off wasn't too smart. But the thing which seemed to bother him most was that he had lost flying speed in attempting an impossible turn back to the field. Sure, he knew about landing straight ahead, he said. but in the excitement he had followed the natural instinct to land on an airport.

Well, there it is boys, and unless you prepare yourselves by continued rehearsals, you, too, will do what comes natural in such an emergency. First, you've got to rationalize this thing, and to indoctrinate *yourself*, to insure that you will do the right thing.

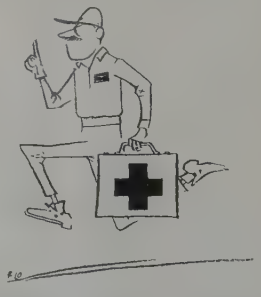
Rationalization goes something like this: "This emergency is especially dangerous because right after take-off I'm in a climb and don't have much excess speed. The record shows that most of the injuries occur when pilots lose flying speed while trying to make a sharp turn back into the field. I must make sure of my speed *first*, before I start to maneuver. If I can just get my wheels on the ground any place, with the plane still under control, I'll be okay."

After you have this firmly fixed in your mind, condition yourself as to the correct action. Visualize the emergency on your take-offs. "My engine quits *now*! Snap that nose down! Don't lose flying speed! Too low to turn back! There's a clear spot just ahead, to the right! Easy now; make it good. Don't lose flying speed!"

And continue to practice this take-off emergency until you are sure, damn sure, that force of habit will overcome your natural instinct.

Ignorance is Reprehensible—Dilbert has the idea that aviation is just one continuous round of flight hazards and emergencies. For him it is, because he doesn't know what it is all about. And he is too lazy-minded to find out.

There *are* hazards, but if you recognize them before they become emergencies, they are already half licked. There remains only to take the necessary avoiding action. The really sad emergencies are those which occur because of Dilbertic ignorance.



SETH'S SAFETY QUIZ

1. If you are operating with power settings for maximum endurance, will you automatically get maximum range?

2. Why is it dangerous to remain in inverted flight for more than a few moments?

3. An under-inflated tire is apt to cause a groundloop. True or False?

ANSWERS

1. No. Maximum range settings are those which will give you the most *miles* (over the ground) per gallon. Settings change with load conditions and altitude. Maximum endurance settings are those which will give you the most *hours* in the air per gallon, with no consideration to distance made good.

2. Engine failure. Unless you have a specially designed engine, you will soon lose oil pressure.

3. True. It offers more friction, tending to turn the plane to that side.

Ramjet Interceptor

(*Continued from page 17*)

at combat altitude no longer suffices to produce full efficiency in the ramjet.

The supersonic fighter must be able to climb to operational altitude in not more than two or three minutes, and possess a thrust/weight ratio in the region of one. The ramjet, which weighs only a fifth to a 10th as much per unit of power as the turbojet, would appear capable of fulfilling these requirements. The temperature range, utilizable for thrust and compression, between the air temperature at the end of the compressor and the permissible fire-gas temperature at the turbine blades dwindles as the airplane's supersonic speed increases, entailing a reduction in thrust in relation to frontal area in the turbojet engine to well below that of the ramjet, and an increasing reduction in compression power in the afterburner.

On the other hand, the structural materials of the ramjet place no limit on chemical heating at Mach numbers presently considered. The economic importance of this factor is obvious since it permits a considerable saving in strategic materials and circumnavigates the bottlenecks in turbojet production now looked upon with concern in the industry. The need for special starter motors for the ramjet-powered airplane, owing to its lack of static thrust, may not be such a problem as has often been suggested (as an interim measure the Leduc -021 employs small wingtip turbojets) and it is likely that it will be solved by the use of mobile catapults for take-off, or by cheap liquid rockets with a high water content in the propellants. Thus, the manned ramjet fighter may well form the next step in defense against sonic *and* supersonic bombers of the next decade, a view shared by many top-line German designers during the later years of World War II, some of whom have doubtlessly taken their ideas with them to Soviet Russia.

Development

The father of the ramjet is generally considered to be a Frenchman, Monsieur Lorin, who published his ideas for a thermo-propulsive duct in *L'Aerophile* in 1913, but whose researches were more or less neglected and then given up until, 20 years later, Rene Leduc, unaware of Lorin's early research, began work on ramjet developments. Tests were made in 1935 on a small ramjet unit fitted on a weighing scale and fed with a sonic air stream, an efficiency of 9.5 per cent at the intake duct being recorded at a wind speed of 679 mph. After protracted trials with various diffuser shapes and fuels, official recognition came and the *Service Technique du Ministere de l'Air* ordered the design and construction of a research airplane to test this "new" prime-mover.

Construction began at the Breguet plant near Paris in 1938; a one-fifth scale model was exhaustively tested in the Eiffel wind tunnel, various sections were tested at Mach numbers from 1.6 to 2.35 and a series of tests on the double-cone diffuser were made during the following year, but with the German invasion of France, the partially completed airplane was sent to Toulouse in Unoccupied France where it was safe for a time. German interest in the potentialities of the ramjet were by then well-known (Sanger, Lippisch and Pabst having undertaken much advanced research work during the war) and the Germans immediately ransacked Rene Leduc's Vesenet apartment in search of test results, but without any luck.

Work on the project continued at Toulouse, with the sanction of the Vichy Government, until the plant was wrecked by bombing in 1944. But after the liberation, work was resumed on the prototype and the airplane was completed in 1945. As a ramjet has no static thrust, it cannot be self-starting and it was, therefore, decided to launch the airplane from a parent transport. For this purpose a four-engine Sud-Est *Languedoc* was modified by having a front support structure and a rear telescopic strut built above the fuselage, the attachment points being mounted on stress-measuring gages so that the aerodynamic forces could be determined and the launching made less hazardous. Known as the Leduc-010, the ramjet airplane was mounted on top of the *Languedoc*, the combination taking off from Toulouse airfield for the first time on November 19, 1946.

In October 1947, this 1937-designed airplane left the "parent" in the air for the first time when Leduc's test pilot, Monsieur Gonord, released the Leduc-010 at a little above 9,000 feet, gliding at 112 mph to test the plane's aerodynamic characteristics. After numerous gliding flights, the first powered flight was undertaken 18 months later, the *Languedoc* climbing to 13,120 feet and then launching the Leduc-010 in a shallow dive at 10,000 feet, with the slow burner turned on. Pilot Gonord maintained the dive until 320 mph showed on the clock. He then switched on 250 of the 500 burners installed in the ramjet duct. A speed of 445 mph was rapidly reached and Gonord was forced to throttle back and climb to keep within the flight-program limits. After flying for nine minutes, the Leduc-010 landed, terminating the first powered flight of a man-carrying pure-ramjet airplane.

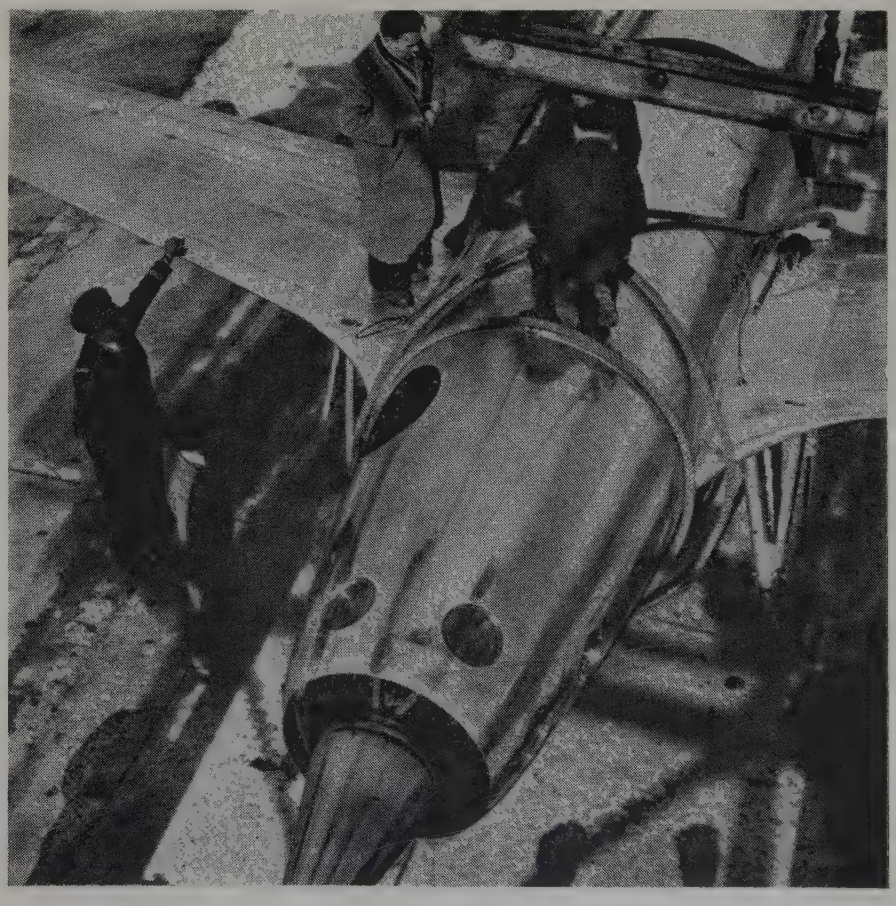
Many other flights were made on half-power during the months that followed; on one such flight a speed of 505 mph was recorded at over 36,000 feet, at which altitude the climbing speed was still *8,000 feet per minute*. A second Leduc-010 was delivered to the test team, and these two prototypes have since flown at speeds well in excess of 600 mph *on half power*. In February last year, a third machine joined the team. This airplane, the Leduc-016, differed from the 010 in having a 220-pounds thrust Turbomeca *Pimene* turbojet mounted at each wingtip. The thrust of these units, while insufficient to enable the airplane to leave the ground unaided, provided standby power in the air or for landing, and provided much of the data on flow characteristics of tip-mounted jets for use in the Leduc-021 fighter.

Fighter of the Future

The Leduc-021 single-seat fighter is very similar in appearance to the earlier 010 and 016 research airplanes but about one-third as large again (The Leduc-010 spanned 34½ feet and had a length of 33 feet 7 inches). Whereas the streamlined central body containing the crew was mounted inside the intake duct of the earlier models, the two occupants looking out through perspex port-

(*Continued on page 52*)

LEDUC-010 is shown here about to be lifted onto the back of its parent airplane for an air launch. Note the flat portholes out which crewmen, in central body mounted in intake duct, look



Ramjet Interceptor

(*Continued from page 51*)

holes which coincided with portholes in the duct walls, the cockpit of the fighter is mounted clear of the intake duct to improve visibility. This cockpit, which, after initial tests, will be fully pressurized so that the airplane can attain altitudes at which the ramjet can reach its full efficiency, is fitted as a jettisonable capsule to which are attached three emergency parachutes.

The cockpit and the rest of the central body is suspended in the entrance of the intake (which has a diameter of seven-and-a-half feet) by a system of the cross-bracing struts which connect up to sturdy light alloy rings providing the necessary support, and the rear half of the central body accommodates the accessories (*i.e.*, injector pumps and generator driven by an auxiliary gas turbine). Aft of the central body the compressed air is divided into several "layers" by rings. Round the edges of these rings are arranged the injectors and burners so that the fuel is evenly distributed and a good mixture obtained.

The fuselage comprises a double-skinned duct having Z-section frames at short intervals and Z-section longitudinal stringers, interconnected by gussets. The wing crosses the duct and the central body and is built around a twin-web box spar carrying a detachable leading edge, slotted flaps and ailerons with set-back hinges. The resulting thick-skinned box forms an integral fuel tank, and the roots provide accommodation for two 30-mm cannon and shell feed.

In order to obviate the need for launching from a parent aircraft and while suitable methods of catapult launching are being evaluated, a 840-pounds thrust Turbomeca *Marbore II* turbojet is mounted at each wingtip, the combined power of these units being sufficient to lift the Leduc -021 off the ground and attain an airspeed at which the ramjet can be lighted. Owing to the small size of these units, it is unlikely that they will occasion any serious reduction in performance at the top end of the fighter's speed scale. The tail surfaces are attached to the shell structure without crossing the duct, and the landing gear comprises tandem mainwheels which retract into a central fuselage housing and wingtip skids.

Although little can be said with regard to the estimated performance of the Leduc-021 fighter, Monsieur Leduc has revealed that climb rate will be of the order of one and a half to two minutes to 32,809 feet, and that duration will be around 15 minutes at 50,000 feet. Flight testing will begin in the Fall, and will be conducted in stages with full-power trials probably starting next year. It is Rene Leduc's belief that a climb rate in excess of 20,000 feet per minute will be obtained and that advanced developments of the Leduc-021 may achieve speeds up to 2,000 or 3,000 mph, when the heat conveyed to the skin by friction (1,100° F.) will ultimately limit speed.

It is perhaps typical of man's inertia that the bulk of the vast funds being expended on fighter developments throughout the world are being allocated to the development of machines using the turbojet as the prime mover, while only a very small amount is being devoted to the ramjet-powered fighter with its greater potentialities.

MARINES of 1st Marine Div. in Korea load and unload from a Sikorsky helicopter which shuttles them between front line and rear areas. 'Copters recently shuttled over 2,000 men

Sikorsky . . .

(*Continued from page 21*)

faith. In it Sikorsky made cross-country flights and won his pilot's license. Invited to take part in army maneuvers, he flew for an hour at 1500 feet. Also, he began to earn money giving exhibition flights.

Now, using everything he had learned, Sikorsky and his crew of amateurs built a plane with a 100-hp motor. It flew at 70 mph with pilot and two passengers, breaking the world's record and winning the highest award in the Moscow aircraft exhibition. Sikorsky had arrived. Just before his 23rd birthday a Petrograd firm bought exclusive rights to manufacture his planes, and made him designer and chief engineer of its plant. Within two years he paid back the $25,000 his family had risked on his career, and was on his way to making a fortune.

Sikorsky arrived in Petrograd with plans for a huge craft with four motors, four propellers and an enclosed passenger cabin. Skeptics said that such a monstrosity would not rise from the ground. On a test flight the "Grand," as it was dubbed—the world's first four-motored plane—remained aloft an hour and 54 minutes with eight passengers on board! Czar Nicholas came to see the plane and presented Sikorsky with a gold watch. A new Sikorsky giant, finished in 1913, quickly became the wonder of the aviation world. It could carry 16 passengers, and had provisions for heating and electric lights.

For several years, world aeronautical progress had been slow because of the caution of investors. So while Glenn Curtiss was planning his big flying boat, the *America*, and Geoffrey de Havilland of England, Anthony Fokker of Germany and others were building light military planes, Sikorsky stole a march on the aviation world with his giant craft.

When war broke out, Sikorsky built 75 four-engine bombers which made hundreds of raids on German targets. Then came the Red revolution. Sikorsky abandoned his fortune—some $500,000 invested in real estate and government bonds—and fled to Murmansk, where he got aboard a crowded English boat and headed for the United States. He landed in New York in March 1919—with $600, no friends and little English. At 30 he was back again at scratch.

He rented a $6-a-week room, allowed himself 80 cents a day for meals, and began frequenting flying fields. His first break came from the prophetic General Billy Mitchell, who sent him to Dayton, Ohio, to design a superbomber for the Army. The appropriation ran out after six weeks, and he was back in his hall bedroom.

Then he got a job teaching mathematics in a night school for Russian immigrants. As students learned of his background, he was asked to lecture on aviation and astronomy. His predictions about the future of flying excited his students, many of whom were skilled workmen, and they offered to help him. Meetings were held and the hat was passed. A Russian refugee who ran a farm near Roosevelt Field, Long Island, offered his outbuildings for a workshop.

In the spring of 1923 the Sikorsky Aero Engineering Corporation was formed on less than $1,000 capital, and work was begun on a two-engine passenger plane. Michel and Serge Gluhareff, Russian glider inventors, and Michel Buivid, an engineer who was Sikorsky's schoolmate in Kiev, came to work for $15 a week. They bought a second-hand drill press for $1.80, made shears for cutting aluminum from an old auto bumper, got angle irons from bedsprings in a junk yard, and bought other parts in five-and-10 stores. When some of the makeshift parts wouldn't fit, Sikorsky redesigned the plane.

When it came time to make the fabric

coverings for the wings, Sikorsky's sister Helen (who had married and moved to Long Island) volunteered with her sewing machine. Her son, Jimmy Viner, now Sikorsky's chief test pilot, swept out the shop and ran sandwiches for the workmen.

For 20 weeks no one was paid. The discovery of the American baked bean probably saved the venture. When things got really bad, Sikorsky pawned the Czar's watch.

On completing the plane, the gang of helpers enthusiastically swarmed aboard for a test flight. Sikorsky didn't have the heart to turn them out, and the overloaded plane was badly smashed in a forced landing. The men were only scratched, but for Sikorsky it once more looked like the end of the road.

Fighting for his future in aviation, Sikorsky called a meeting of the 50-odd stockholders and friends who still believed in him. Eloquently outlining his plans, he asked them to put up $2500 to rebuild the plane. He got the money. The rebuilt S-29 which carried 14 passengers and cruised at 100 mph, was an immediate success. Orders came in for more planes, and eating became a routine habit.

Sikorsky next designed the famous S-38 10-seater amphibian. Airlines placed large orders, and his new plant at Bridgeport, Conn., turned out more than a hundred of the big ships. They pioneered long-distance mail and passenger service throughout the Western Hemisphere. The Sikorsky *Flying Clippers* followed, the firm became a branch of United Aircraft Corporation, and to all the world the name Sikorsky came to mean fast, luxurious overseas air travel.

Meanwhile, Sikorsky's heart was still with the helicopter. Through the years he had snatched time to sketch improvements and take out patents. Now he saw that big planes using a longer runway had increased the need for a flying machine that would take off and land on postage stamp. In 1938 he whipped his plans into shape and took them to the heads of United Aircraft. Henrich Focke of Germany had actually flown a rotary-wing craft the year before, but experts were still dubious. Sikorsky radiated such conviction, however, that the firm risked $1,000 on experimental work. As a matter of frugal habit, he used an old Ford rear end for the transmission shaft of his first helicopter framework.

A year later Sikorsky rolled a weird contraption from the hangar. Nothing could look less birdlike than this squat framework of pipes housing a motor and topped by a strange horizontal propeller. Only Sikorsky knew how the beast should work, and he had to learn to fly it. Since you can practice with a helicopter at an altitude of three feet, he tethered it with a ball and chain. To the amazement of onlookers the ship rose from the ground.

For two years he tore down and rebuilt, made longer and higher flights, and proved the amazing versatility of a flying machine that could rise vertically, stand still in the air, skim treetops safely and land almost anywhere. The Army ordered its first helicopter in 1942, and the ship was flown from Bridgeport to Wright Field at Dayton, Ohio, making the first cross-country helicopter flight in the Western Hemisphere. Since then more than 800 Sikorsky helicopters have been built, other designers have come along with variations and the "flying windmill" has acquired a reputation as an angel of mercy in both war and peace.

But the helicopter's career has only begun, says Sikorsky. As jet transport liners come into their own, still longer runways will be needed and big airports will be pushed farther from town, creating a demand for helicopter "bus service" from city rooftops to airports. For this sort of service Sikorsky has already created the 10-passenger S-55, largest helicopter to have received a Civil Aeronautics Board certificate of airworthiness. He has delivered two of these crafts to Los Angeles Airways. Not only will they carry mail and passengers from downtown Los Angeles to the airport; passengers will be able to board regularly scheduled runs from outlying towns and fly directly to the airport for connections with long-distance airliners, cutting down the usual transit time on congested highways from one or two hours to half an hour or less.

Now 63, Sikorsky is a shortish, stocky man with thinning hair and a close-cropped mustache. He has punctilious Old World manners. "In the 30 years I have worked for him," says an associate, "he has never raised his voice, pounded a table or failed in courtesy. If you make a suggestion he'll say, 'That's perfect! Now let's work it out this way.' He may change your idea completely, but you always think you've done it yourself."

He has a gift for explaining aeronautical science to the layman and is in great demand as a lecturer. Leaning forward intently and speaking with a slight accent, he puts things so precisely and simply that any bright schoolboy can follow him.

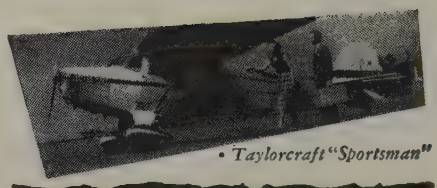
Once he was present at a technical symposium where different types of helicopters were being appraised. There is a great difference in opinion about rotor design among helicopter manufacturers. Sikorsky has staked his career on the single overhead rotor, with a small tail rotor to keep the craft itself from rotating. At the meeting there was no one present to describe the twin-motor type manufactured by a rival. Sikorsky volunteered, and set forth his rival's claims so persuasively that a stranger would have thought he was describing his own ship.

Behind his suave exterior, Sikorsky is something of a mystic. He has written several books on his religious philosophy, one of them on the inner meaning of the Lord's Prayer, which he has contemplated on lonely country walks. He is a pillar of the Bridgeport Russian Orthodox Church, many of whose members came to Bridgeport with Sikorsky when he set up his plant there.

What next for the Grand Old Man? He has visions of a 100-ton helicopter, driven by jet power mounted at the blade tips, that will lift big freight loads over rough terrain, speeding construction jobs in remote areas. And under government contract he is working on a new hybrid ship—a kind of fixed-wing craft that will combine the helicopter's vertical take-off with the greater cruising speed of the airplane.

Some people say these things cannot be done, but in the Sikorsky plant there is a sign which reads:

"According to recognized aerotechnical tests, the bumblebee cannot fly because of the shape and weight of his body in relation to the total wing area. But the bumblebee doesn't know this, so he goes ahead and flies anyway."



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Executive Pilot

(Continued from page 29)

quired. A small company owning, for example, a single-engined *Navion* or *Bonanza,* can use a pilot who does something else for the company when not on flight.

Larger planes require two pilots. Some companies try to cut down on expenses a bit by hiring a combination copilot/mechanic. However, I personally know of only one pilot who is also a good mechanic and will work at it. We have him on our payroll, and he doubles-in-brass on our scheduled runs between the Los Angeles and Phoenix factories.

A recent news bulletin of the ALPA (Air Line Pilots Association) lists the wage and hour agreements recently signed with Pioneer and Ozark Airlines. These salaries for captains and copilots might be of some help in determining the pay scale for an executive pilot. Captains on Pioneer with eight years seniority are paid $945 per month for 80 hours flying, half day and half night, in a DC-3. Captains of the Martin 202's draw $1,097.40. DC-3 copilots with five years seniority draw $574 in DC-3's and $604.86 in Martin 202's. Copilots with eight years seniority draw $635 in DC-3's and $664.86 in Martin equipment.

The ALPA agreement with Pioneer continues, "Copilots to be paid $350 per month for the first year and $400 monthly for second year. On DC-3 equipment, copilots will receive captain's base pay and 40 per cent of captain's flight pay during third year, 45 per cent of captain's flight pay during fourth year, 50 per cent of captain's flight pay during fifth year and thereafter. All pilots have a 60-hour guarantee based on 70 percent day and 30 percent night."

The ALPA agreement with Ozark Airlines, signed March 21, 1952, gives eight-year captains $924.67 for 80 hours per month. Copilot pay begins at $315 monthly with a top of $490 in eight six-month period raises of $25 per unit.

With multi-engined equipment and a well-trained crew, it is completely practical to fly any weather that the airlines do. However, the best possible guide for going or staying on the ground is to check with the airline operations office. If the airlines cancel because of weather at the terminal you're heading for, tell the boss that you're going to stay on the ground. I know of only one company president who told his pilot to go against his better judgment. He was sort of a religious fanatic who said that he didn't care about the weather.

"The Lord will take care of us when we're up there," said the executive. "Let's take off."

"The Lord may be taking care of you, but perhaps I haven't led such an exemplary life," said the pilot. "You can get yourself another pilot, because I'm not taking off in this kind of weather."

The pilot quit on the spot.

Don't think that some of these executive pilot's aren't really sharp. Bob Vinson, for instance, who flew the "Yankee" baseball team president Del Webb all around the country in a De Havilland *Dove* and formerly in a big Twin-Beech, has cancelled out only five times in five years.

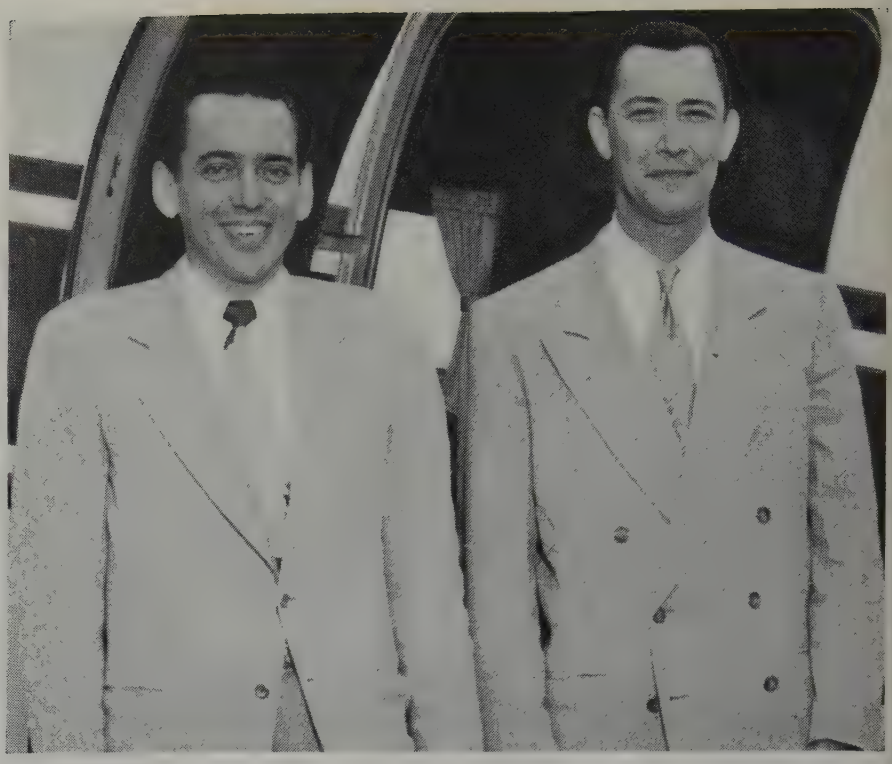
Four or five times each year a company executive will ask me to recommend a pilot. I never make a specific recommendation, but there are always 15 to 20 applications for flying jobs in my desk drawer. I turn them over to the executive and let him make his own decision.

These executive pilots are, and must continue to be, of the highest caliber. Their job is infinitely more difficult than the regular airline operation where you shuttle day after day over the same route. The executive pilot must be qualified to take off and head his airplane for almost any spot in the world —even if he has never been there before.

Many of our executive pilots are authorized to spend hundreds of thousands of dollars of the company's money on aircraft modification and overhauls. They must be strictly high-class people.

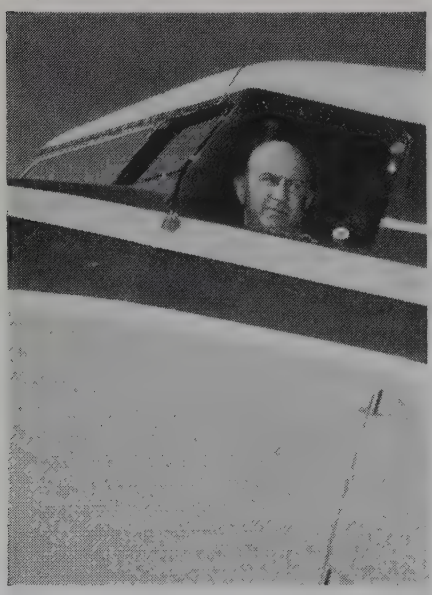
That's why I always recommend that executive pilots be extremely well qualified. I like to see at least 2,000 hours on the log books, at least 1,000 hours of cross-country time, 500 hours of night flying and an instrument rating on a commercial license. Preferably, the executive pilot should have an airline transport rating (ATR) but some of the older pilots will no longer qualify for the ATR because of minor physical waivers.

If you can afford an executive transport, you can't afford anything less than the best pilot you can find. And there are several good ones available.



FRONT-OFFICE commanders of the American Republics Corporation *Lodestar* are Pilot Ray Peters (*right*) and Copilot Bill Sims. Peters holds an ATR, Single and Multi-Engine Land, Instructor Rating, Dispatchers Certificate and A&E. To date, he has logged about 7400 hours. Copilot Bill Sims has Commercial ticket with single and multi-engine rating, an Instrument Rating, and an A&E. He has logged 500 hours as pilot. They are based at Houston, Texas

PILOT BELLANDE averaged 600 hours a year at the controls of AiResearch DC-3



Editors Note: Eddie Bellande has logged over 23,000 hours in the past 37 years of active flying. As chief test pilot of Lockheed, he checked out Wiley Post in the famed "Winnie Mae." He co-piloted Lindbergh on the first TWA transcontinental run. He flew the very first of the Lockheed Vegas. *Eddie Bellande learned to fly in 1915 in an old Curtis seaplane and was the youngest licensed pilot in the United States upon completion of his training. He was a Navy pilot during World War I at Pensacola, Florida. Later he became one of the original barnstormers with time spent in skywriting, crop dusting, movie stunt flying and test flying. He helped pioneer the Maddox Airlines which later became TWA. During World War II, Eddie averaged better than 600 hours a year at the controls of AiResearch executive DC-3's.*

Radio Aid to X-C

(*Continued from page 19*)

field. From the remarks I gathered that my point of intended landing was closed to all transient aircraft. A quick change of plans brought me to an alternate airport where I was able to set down immediately—minutes ahead of a rain squall.

At other times, you will be beyond the range of tower conversation. But you may still wish to learn facts concerning odd conditions at your point of landing which may have arisen since your take-off. In such case, you may call the nearest CAA station which will relay your request over a ground communications net.

So much for radio as a routine help. Now how about radio as an aid to navigation?

Increasingly, VOR (VHF Omnirange) and other automatic and semi-automatic devices are making the job of radio navigation comparatively simple. There are thousands of private aircraft, however, which do not yet possess these advanced aids. Still within the scope of the average pilot's experience and ability are the low-frequency range facilities. How to use them?

Many private pilots seem to feel that radio navigational aids, especially range stations, are for the use of qualified instrument pilots only. Not true.

An instrument rating is a goal for every private pilot to shoot at. And under the proper guidance, every such flyer should strive to reach this goal. But even without an instrument rating—provided you comply with CAA regulations and fly VFR only, there is absolutely no reason why you cannot use every low-frequency range station available. Within limitations, these facilities present excellent navigational aids.

The CAA publication, "*Flight Information Manual*," available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., and selling for $1.00, includes pertinent information for the use of these radio ranges. After procuring your copy, study the instructions pertaining to this type of radio navigation. And at every opportunity, improve your efficiency in this important area of pilot technique. You'll find that your "right-hand man" will pay off big dividends in the matter of: 1) helping you locate your cross-country positions, 2) determining fixes and ETA's, and 3) keeping you on course.

Capable as these low-frequency radio navigational aids may be, however, today's private pilot should not by-pass the improved facilities which are available to him. Radio navigational research follows a twofold plan, always seeking to give the pilot a more accurate device with less demand upon the operator himself. Let's look over some of these improved radio aids.

One is the Visual-Aural Range, known as VAR. If you have used the low-frequency system, referred to above, you know that the constant on-course signal can become extremely monotonous (one of the limitations). Another shortcoming of the old range set-up is the uncertainty which is sometimes apparent in regards to the fade or build. Especially is this true in the case of the pilot who is unfamiliar with the system. A student of mine once flew a weary 30 miles before he was certain that he was hearing a build.

(*Continued on page 56*)

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Radio Aid to XC

(Continued from page 55)

VAR overcomes these and other handicaps in that the system balances on aural signal—just as in the old plan—against a visual reference. By comparing the blue-yellow indicator mounted in the cockpit with the audible code, and checking both against significant chart information, the pilot has an immediate position fix. Instructions for this method are also available in the "*Flight Information Manual.*"

Then there is the system for the lazy pilots. I say "lazy" because I too belong to this breed. I like nothing better on a long cross-country than to relax the old grey matter and let the radio do all the navigating, especially if I can tune in my favorite commercial program at the same time. "God bless," says I, "the dear gentleman who gave to us the automatic direction finder."

Basically, this system involves the use of a special radio installation—the automatic radio compass—and the pilot's familiarity with any one of a number of broadcasting frequencies. These may be CAA radio stations, commercial broadcast stations or Aunt Minnie's diatherm, rest her aching back.

The ADF, like other radio aids, has its imperfections. Commercial stations are not as dependable as the CAA range stations. Remember, too, that several commercial stations may share the same frequency, depending upon geographical separation for lack of interference. While flying cross-country, you can conceivably go in circles while homing on the same frequency. Thunderstorms have an irritating way of attracting that old homing needle, too. But with these limitations in mind, the private pilot will find that the automatic radio compass is an extremely helpful "right-hand man."

Most advanced of all radio navigational aids available to the private pilot to date is the Omnidirectional Range system—designated as VOR. (Don't confuse VAR with VOR. Remember "O" is for Omni.)

In essence, this consists of a ground station which transmits a 360° signal. Actually, then, any path the pilot chooses to fly to the station is "on course." Operating within the 112-118 VHF megacycle band, more than 300 of these installations bracket the country to give the private pilot an accurate and simple radio assist. So efficient is this system, in fact, that the CAA plans to drop all A-N and other low-frequency communications when the complete Omni program is completed sometime in 1953. To date, however, we have 45,000 miles of VHF airways in the U. S. added to the still-existing 65,000 miles of LF airways.

As useful and comprehensive as radio is, its one major shortcoming lies in an area which most of us are prone to aggravate. Voice transmission. Fact is, voice is tending to obviate code transmission to the point where the majority of private pilots don't even bother to learn the old Morse anymore. We ought to have our backside bumped for being so short-sighted.

Static hasn't been altogether overcome yet. And all the electronic aids in the world notwithstanding, there are times when the old radio chooses to act up. That mellifluous baritone in the control tower sounds like a cross between Gravel Gertie and Grendel's mother—both with laryngitis. This is when the old Morse becomes mighty important.

Don't neglect your code. You might get caught on top like I did in Texas one time when my voice transmission went completely blooey. An instructor back along the line had insisted that I learn code. Thanks to him, I was able to pick up altimeter setting, ceiling, etc., all by the use of code.

Then there's another place where wireless code comes in handy, "Q" signals. "Q" signals are the codes worked out by the International Civil Aviation Organization to answer the main objection to the use of Morse code in the first place: the long drawn-out job required to say anything via this method.

Over the years, it has been found out that there are certain, basic exchanges of ideas which occur most frequently between aircraft and ground stations. Most of these messages refer to emergency or other vital procedures. Consequently, many phrases have been reduced to a three-letter code, each beginning with the letter Q. Hence, "Q" signals.

QFE means, "The present barometric pressure at official aerodrome level at..... (place) is....." Similarly, QRD means, "I am bound for.....from....."

The obvious value of this shortened system is apparent. To make a question out of any positive statement, the "Q" signal is followed by the prosign IMI. The whole list appears in United States Air Force and United States Navy "*Radio Data and Flight Information.*" If not available, drop into the nearest military base and copy the "Q" signal list. Post it in your airplane. Some day this radio aid may mean the difference between a crash and a happy landing.

Every pilot should also be familiar with the three basic classes of distress signals which operate on the U. S. Emergency and Safety frequency of 8280 kc. and the International Distress frequency of 500 kc. These are:

1. *Safety.* If you are lost or expect an emergency, but you can still proceed or land at a suitable field with help from a ground, communications station, you may:

A. On CW (Morse code), use the International Safety signal, TTT.

B. On voice, use the word SECURITY.

A station will answer you and, after identifying itself, request you to transmit for a fix. To do this:

On CW, transmit a 20-second dash followed by your identification. For VHF voice, count from 1 to 5 and back. If using HF, hold the microphone button for 20 seconds. Do not transmit on voice during this time.

2. *Urgent or Emergency.* This means you need navigational aid right now. On CW, call any station, using the International Signal XXX. If calling a known station, use the precedence prosign and follow the normal method.

On voice, call PAN. Make your call and ask for a fix as you would in the safety procedure. Include: 1) Estimated position and time it was calculated, 2) Course, speed and altitude. Transmit your estimate of the time you will remain airborne and whether or not you mean to make a crash landing.

3. *Distress.* This is a hot one and means that you are really in trouble. On CW, use the International Distress signal SOS, like this: SOS SOS SOS V ABC ABC ABC (20-second dash) ABC K. Listen. If no reply, repeat.

On VHF voice, transmit MAYDAY three times, followed by your identification three times. For HF voice, transmit MAYDAY three times followed by your identification three times, then depress your microphone button for 20 seconds, and give your identification again.

At first glance, the above may seem unduly detailed. Not if you study it for a few moments. Have the information aboard your airplane. Then, if you need it, there will be no unnecessary delay.

There remains one final use of the radio which is of inestimable value to all private pilots. That is the cooperation shown by CAA personnel in forwarding or relaying any legitimate message which the pilot may wish to send. A word of caution here: This is a matter of courtesy on the part of the CAA and is a privilege which is not to be abused. Furthermore, the CAA cannot forward a message when any expense is connected with the transaction. In other words, the message must be confined to local telephone calls or CAA equipment. One businessman friend of mine has a standing agreement with the boys in the CAA office near his home whereby he radios his position as he approaches the airfield. In turn, the Communicator telephones this man's wife who is always at the airport to greet him when he lands.

Many and unending are the variations on this last twist. Don't abuse it—and don't forget to say thank you. Just one more way in which your radio will prove its worth to you as a first-class "right-hand man."

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HAWKER SEA HAWK is shown here on flight deck of *HMS Illustrious* during proving trials. *Sea Hawk* is powered by Rolls Royce *Nene*, carries four 20-mm cannon

Sequence Reports

(*Continued from page 26*)

For example —> 20 + 35 means a west wind of 20 mph with peak gusts to 35 mph; —> 25 Q 50 indicates a west wind of 25 mph with peak gusts in squalls to 50 mph.

Tornado and *water spouts* are still sent in full. No symbols will ever be used for these two phenomena.

These changes have been incorporated in the sequence reports in order to give the pilot a clearer picture of the local weather. It is now possible, with a little practice, to get a very accurate indication of what to expect at the next station by simply studying the hourly sequence reports. They are put on the teletype each hour for your benefit, learn to use them. See how well you can interpret the following examples.

ATL 3⊙15—◍M 30+1 150/63/60→5/986
CHI M 2⊕V½ 145/66/65 ←3/988
MIA 35⊙E 250◍10 172/84/71 ↑13+25
/003
MKC P 5⊕1 RWFK 146/66/64↗3/997

1. What is the ceiling at Atlanta?.....
   A. 300 feet
   B. 1500
   C. 3,000 feet

2. What is the altimeter setting at Chicago?.....
   A. 31.45
   B. 29.66
   C. 29.88

3. Which station is most likely to have fog within the next hour?.....
   A. Atlanta
   B. Chicago
   C. Miami

4. What type of ceiling is indicated at Kansas City?.....
   A. Pilots report
   B. Precipitation
   C. Balloon

5. The temperature at Miami is?.....
   A. 71
   B. 84
   C. 35

6. The visibility at Atlanta is?.....
   A. 1 mile
   B. 3 miles
   C. 10 miles

7. The 145 in the Chicago report means?.....
   A. 31.45 inches pressure
   B. 1,450 foot ceiling
   C. 1014.5 millibars

8. The 60 in the Atlanta report indicates?.....
   A. Temperature
   B. Dew Point
   C. Wind Velocity

9. The wind direction and velocity at Miami is?.....
   A. North 13 mph
   B. South 13 mph with peak gusts to 25 mph
   C. South 13 mph, 25 mph in squalls

10. The RWFK in the Kansas City report means?.....
    A. Rain showers
    B. Thunderstorms
    C. Rain showers, fog and smoke

Answers
1. "C" 2. "C" 3. "B" 4. "B" 5. "B" 6. "A" 7. "C" 8. "B" 9. "B" and 10. "C"

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FOREIGN & LATIN AMERICAN EMPLOYMENT 1952 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply. Application forms. Hot List Firms Hiring. $1.00 postpaid. Global Reports, P. O. Box 883-SS, Hollywood 28, Calif.

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SCHEDULED Airline Pilot now flying South America, desires permanent transfer to United States as Executive Pilot. American, 32, married, ATR, DC-3, 7120 hours, Trilingual, speak, read, write fluent Spanish, French, English. 8 years experience as Industrial photographer. Can qualify both positions in one company. Has corresponding ATR for two South American countries. Present salary, $11,500 per year. Location preferences, Florida, East Coast, but will work anyplace U.S. with good future. Write Skyways, Box 330.

INSTRUMENTS

NAVIGATION INSTRUMENTS: Beautiful new and reconditioned precision instruments. Brand new Link Aircraft Sextants with case $37.50; Fairchild averaging type $17.50: Bausch & Lomb Sextants, excellent condition $49.75; Hamilton 24 hour Master Navigation Watches $75.00. Dalton Model "G" Computer (new) $7.50; Weems Mark II Plotter $2.00; Dalton E-6B Computer $10.00: New Pan American A-2 Dead Reckoning Time, Speed, Distance Computer DeLuxe with Leatherette Case $3.00; Astro Compasses (new) $12.50; (Free Catalog). Pan American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

E-6B COMPUTERS, like new $4.95, with leather cases $5.45 ($10.00 value), new, with cases $6.65. BUBBLE SEXTANTS, like new, Fairchild, Ansco A-10. A-10A, Bausch & Lomb A-8A, $16.85 with carrying cases. Money refunded if not satisfied. Kane Aero Equipment Co., 2308 N.E. 23rd St., Oklahoma City, Oklahoma.

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GIANT Of The Air Force, (B-36) Photos of world's largest bomber on actual training missions. Five different 10" by 10" photos suitable for framing of this modern ten engined giant. Dollar bill for one photo or four dollars for all five. Satisfaction or money returned. T/Sgt. John A. Horn, P.O. Box 9193, Fort Worth, Texas.

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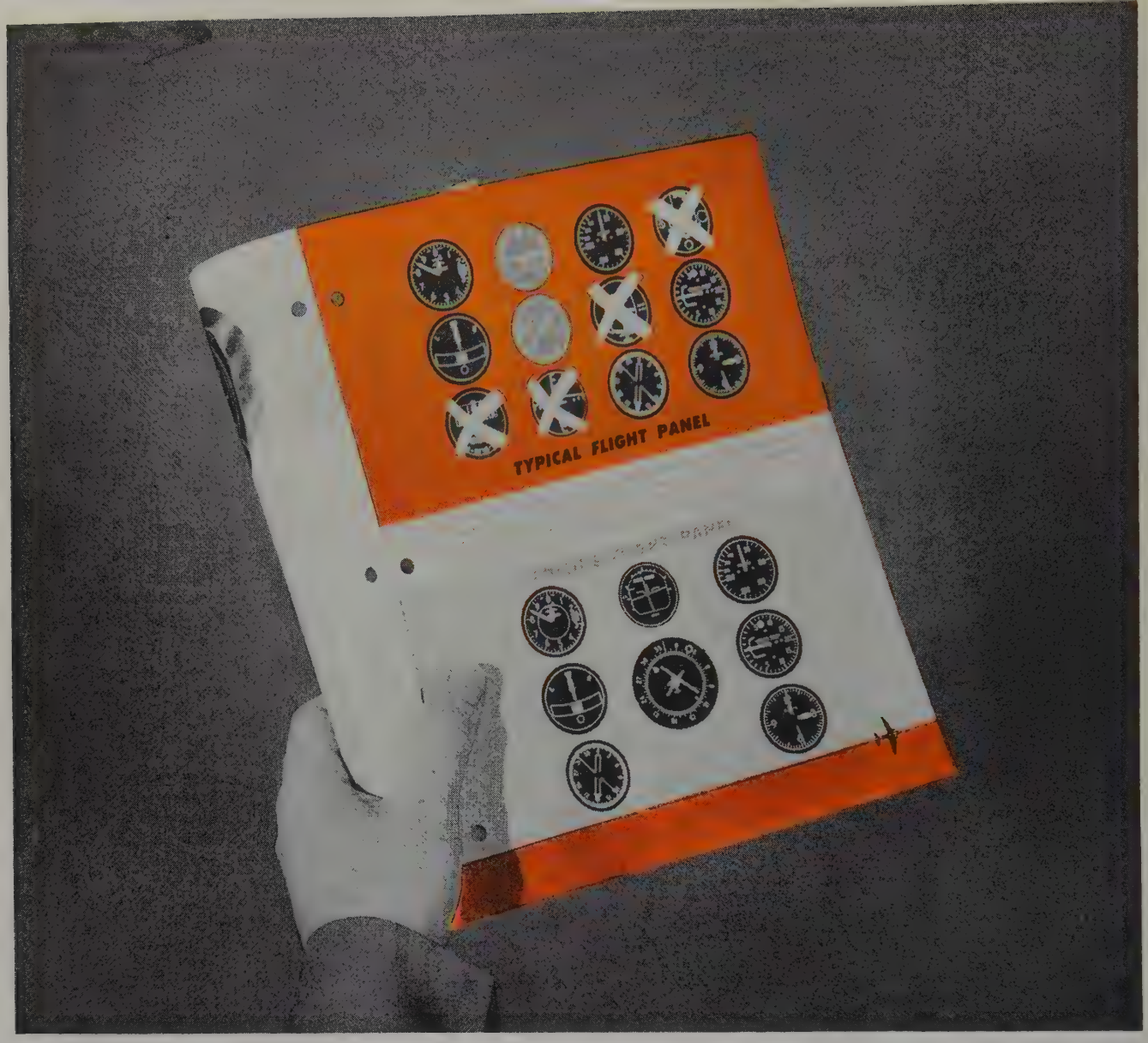

All operators of airline and business aircraft should have the information contained in this pamphlet. It illustrates and describes the operation of the new Collins flight system, which gives the pilot a clear pictorial presentation, on fewer instruments, of all the information he needs for precise ILS approach flying and VOR navigation. Please write us for it on your business stationery.

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NAVICOM

AN/APN-19 is No Stop-Gap for Needed Safety Beacon

Airborne radar beacon AN/APN-19 is not usable as a stop-gap for the missing radar safety beacon because it cannot serve the numerous radars which operate in high-density terminal areas.

This is the principal drawback of the World War II "Rosebud" radar beacon.

Use of APN-19 radar beacons in aircraft has been urged strongly by some aircraft operators as a "better-than-nothing" solution to the problem of fading radar targets on the traffic controller's scope until ANDB's radar safety beacon becomes available.

Many terminal areas where high air-traffic densities make radar traffic control a practical necessity contain more than 50 radars which could trigger this beacon, the engineers explained. This number of almost simultaneous interrogations aimed at an APN-19 equipped airplane would cause a breakdown in the beacon's performance. APN-19 cannot handle this much radar traffic.

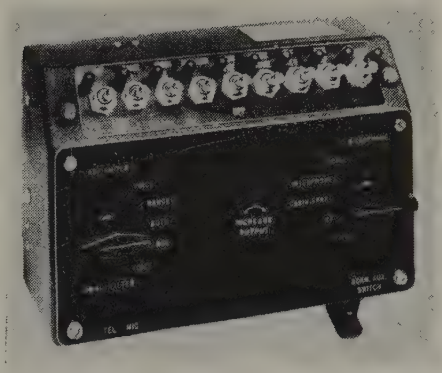
In order for an airborne beacon to serve radar traffic control requirements, it must withstand a large number of radars looking at it at the same time. The beacon must be capable of handling a large number of simultaneous interrogations from all of the radars operating on a particular frequency band in the area. It must also be able to make separate replies to each of these radars "without having a nervous breakdown."

This is one of the difficult problems posed in the development of ANDB's airborne safety beacon program.

Lightweight Marker Beacon Receiver MB-3 Developed

A new lightweight Marker Beacon receiver, the "MB-3", has been designed by Flite-Tronics, Inc. It weighs between seven and eight pounds and will receive either tone or voice modulated signals of visual-aural marker beacons in the 75-mc band.

The receiver features separate sensitivity adjustments for the high and low ranges. The set includes receiver, indicator, and dynamotor-power supply for either 12- or 24-volt aircraft. Receiver matches to 50-ohm antennas. Dimensions are 6¾ x 5½ x 7½ inches, including shock mount. Dynamotor is 5 x 7½ x 5½ inches.



MB-3 Marker Beacon receiver weighs little over seven pounds, receives in 75-mc band

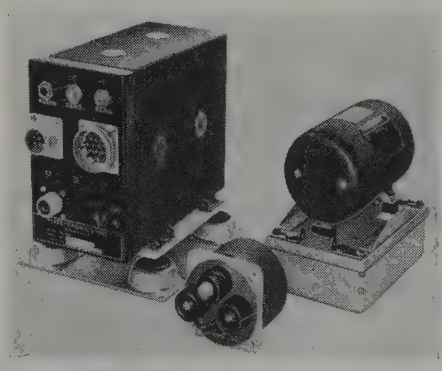
New Nine-Channel Isolation Amplifier, Jack Box Ready

A new nine-channel Isolation Amplifier and Jack Box has been developed by Aviation Accessories, Inc., Fort Worth, Texas. The new Jack Box, designated Model AI 100, is scheduled for production as soon as current tests being conducted by CAA are completed.

Designed specifically for air-carrier use, the new Model AI 100 unit is fully interchangeable with other Commercial Isolation Amplifiers and Jack Boxes currently used by scheduled air carriers.

A unique 45° offset switch selector panel on the Model AI 100 enables the user of the aircraft radio system to see at a glance the eight receiver selector switches as well as the interphone selector switch. This offset panel is claimed by the manufacturer to be far superior to switch-panel arrangements offered by other manufacturers. From a pilot's standpoint, this new offset panel means the end of twisting and ducking the head to see the position of the selector switches.

Another innovation of the Model AI 100, which the manufacturer claims to be an improvement over competitive models, is the quick removable amplifier shelf. This removable shelf is designed for fast maintenance since all component parts are easily accessible for service.



MODEL AI-100 is new nine-channel Isolation Amplifier now undergoing CAA tests

Incorporated in the new unit is a network of resistors which attenuate the incoming radio signal in such a manner that the selection of any combination of receivers by one crew member has no effect on the audio monitored by the other crew members. The isolation amplifier of the unit restores the signal to normal headphone level. In the event that the amplifier unit fails, a 'Normal-Auxiliary' switch is incorporated which by-passes the amplifier unit and allows the users to continue to enjoy reception; but an interlock circuit, with this switch in use, eliminates the possibility of more than one critical receiver being monitored at one time.

Selector switch designations of the AI 100 are to be engraved by the manufacturer to meet customer specifications. Also, an 11-receiver selector model, designed specifically for overseas operations, is slated for early production.

Weems Announces a New Nautical Mile Plotter

Captain P. V. H. Weems, founder of the Weems System of Navigation, Annapolis, Md., and internationally known consultant on air and sea navigation problems, announces the development of the new Mark II-N Plotter.

The availability of this new plotter is especially timely in view of the adoption of nautical miles and knots as common military standards, replacing the former statute mile standard.

The Weems Mark II-N Plotter is similar to the well-known Weems Mark II Plotter, and is used in the same manner, but the distance scales give distance in nautical miles on Air Charts.

Although primarily designed for measuring distances in nautical miles, the new Mark II-N Plotter may also be used for statute-mile measurements. This feature will appeal to many navigators who may want to convert from nautical to statute miles. The ability to convert is made possible by a distance scale in the middle of the plotter giving statute miles on Sectional Charts.

The price of the Weems Mark II-N Plotter is $2.50 each.

New Victor Airways Designated

Fate of old AN ranges depends on the installation of VOR equipment

Pilots now have use of 45,000 miles of "Victor" airways using newly installed VHF omni range stations, according to a recent CAA announcement.

And as CAA publicized this announcement a working group formed by the Air Coordinating Committee's Navigation Panel critically scanned a proposed schedule for decommissioning the 65,000 miles of low/medium frequency (L/MF) four course radio range airways now in use.

The new Victor airways, which in most cases closely follow the routes of old L/MF airways, will eventually displace all but 88 of the four-course ranges and the familiar dah-dits and dit-dahs that have been beating into pilot's ears for as long as 15 years.

However, aviation will not see many of the 333 existing L/MF ranges go off the air until after July 1, 1953, according to ACC's current policy.

Implementation Problem ▶ Decommissioning of L/MF ranges is being held up because installation of VOR receivers has progressed more slowly than expected. Very few of the ranges can be decommissioned until the great majority of user-aircraft are equipped for VOR.

The number of ground stations installed for VOR is more than adequate at present. CAA is authorized to establish 438 VOR stations in the United States. By October this program is expected to be complete to the extent of 387 VOR's. The goal is 500 stations by summer, 1955. Thus, L/MF ranges will no longer be needed as gap fillers in the VHF enroute navigation system.

Procedures and airway designations will be completed this fall. Victor airways are designated with odd numbers for north-south routes and even numbers for east-west routes. Alternate routes are designated by their position relative to primary routes; as Victor 3 east or Victor 3 west.

Receiver Program ▶ The airborne side of the picture is not as good. Estimates indicate that some 12,000 to 15,000 VOR receivers for civil use will have been manufactured by the end of this year. But only half of the scheduled airline fleet are equipped with single VOR receivers (about 600 planes).

Dual installations are desired in the airlines and several of the largest carriers are already 100 percent equipped. The remainder is expected to have dual installations completed by next summer.

For other civil aircraft, approximately 28,000 have the two-way radio necessary for IFR and use of L/MF ranges. CAA hopes to see more than one-third of these equipped with VOR early next year. Corporate aircraft should be fully equipped with this group.

Military installations are moving more slowly. Although the Navy has ordered 4,000 receivers, deliveries are slow and it may take until next summer before half of these are installed. But it is expected that Naval transports will be fully equipped by then.

The Air Force does not expect to complete its VOR installations before 1958. Only 10 percent of Air Force planes will be equipped by the end of the year; 50 percent will be equipped sometime during 1954.

As far as the civil picture is concerned, airborne installations together with the publications of necessary flight procedures will by next year have reached the point where VOR could be declared the primary navigation system for IFR and traffic control. And allowing six months for breaking in the new system, most of the old ranges could be turned off on July 1, 1953.

But lack of sufficient airborne installation among military planes prevents decommissioning of the old ranges.

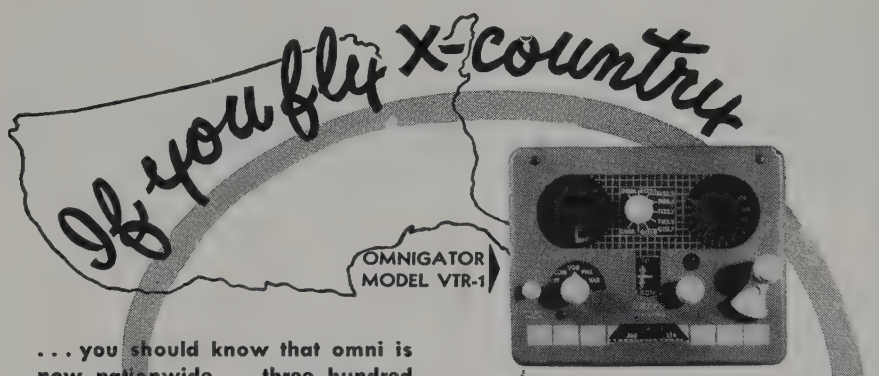
Dual Airways ▶ The matter of duplicate airways is more than a problem of supporting two complete paralleling systems of navigation aids. One or the other must be deemed the primary aid for traffic control purposes. Ability of users to fly the primary aid "determines for the most part the efficiency of air traffic control," the ACC finds.

Concurrent use of L/MF and VOR systems will make traffic control complex. This complexity will mean less efficient control. Traffic control based on the new VOR system cannot be simplified until the L/MF ranges are decommissioned.

On the other hand, premature decommissioning of the low frequency ranges would mean either (1) restricting the movements of non-VOR-equipped aircraft, or (2) deterioration of air traffic control efficiency.

Major factor against decommissioning LF ranges arises from military aircraft. Statistically, by plane movements and numbers, these are the primary users of LF ranges. Military aircraft cannot yet use VOR as a primary aid for lack of

(*Continued on page 64*)



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Leighton Collins, Editor of Air Facts, has logged a comprehensive story, "5000 Miles by Omnigator," in Air Facts Magazine. He states, in summary, "A cross-country exploration and study of our elaborate omni-range and ILS facilities reveal that the system is incredibly good and that, for the first time, the small plane owner has something he can rely on in fair weather or foul, high or low, and especially in thunderstorm areas."

For a complimentary copy of this Omnigator story, write NARCO.

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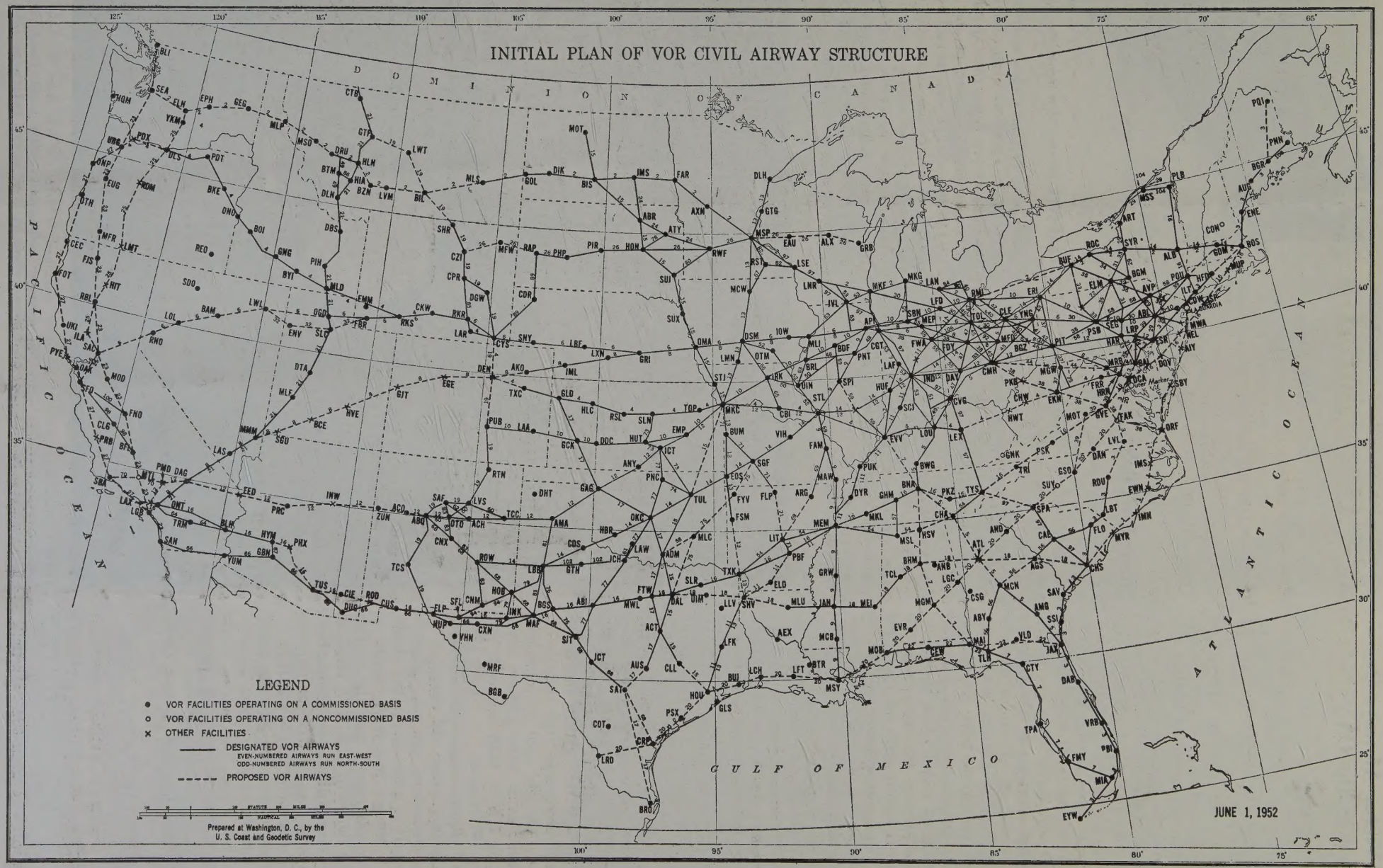

INITIAL PLAN OF VOR CIVIL AIRWAY STRUCTURE
D O M I N I O N O F C A N A D A
P A C I F I C O C E A N
A T L A N T I C O C E A N
G U L F O F M E X I C O
LEGEND
VOR FACILITIES OPERATING ON A COMMISSIONED BASIS
VOR FACILITIES OPERATING ON A NONCOMMISSIONED BASIS
OTHER FACILITIES
DESIGNATED VOR AIRWAYS
EVEN-NUMBERED AIRWAYS RUN EAST-WEST
ODD-NUMBERED AIRWAYS RUN NORTH-SOUTH
PROPOSED VOR AIRWAYS
Prepared at Washington, D. C., by the
U. S. Coast and Geodetic Survey
JUNE 1, 1952

VICTOR AIRWAYS are designated on this map indicating the initial plan of VOR Civil Airway structure. Even-numbered are East-West, odd-numbered, North-South

New Victor Airways Designated by the CAA

(*Continued from page 62*)

sufficient airborne equipment.

ACC points out that shutting off LF ranges too soon would:

1. Further complicate the already complex traffic control procedures because of the resulting loss of LF holding fixes and enroute navigation;
2. Have a serious effect on the assigned defense functions of the military;
3. Impair the nation's mobilization effort because severe restrictions would be imposed on movements of essential military and civil aircraft.

Conversion Program ▶ Although decommissioning of LF ranges must be deferred until the majority of using aircraft are ready to use VOR as a primary aid, once the conversion gets started, it must be done as quickly as possible to avoid prolonging the complexity. To establish a logical order in which the ranges can be decommissioned with the least disruption, the old ranges have been divided into five classes by the ACC:

Class 1—Ranges determined to be unessential to all airspace users and not essential for air traffic control, navigation, and national defense (five ranges).

Class 2—Ranges serving as terminal aids at low traffic density airports and which are not essential for enroute airway navigational coverage (18 ranges).

Class 3—Ranges used primarily as aids for enroute navigation on airways which have full VOR coverage at minimum IFR altitude, between terminal airports with approved ILS or VOR instrument approach procedures (147 ranges).

Class 4—Ranges used as instrument approach aids at major airports served either by ILS or VOR approach procedures (79 ranges).

Class 5—Ranges required for a national low frequency system (88 ranges).

Decommissioning will take place in the numerical order of the five classes.

Class 5 Ranges Stay ▶ A variety of special needs require that the 88 full-powered ranges in Class 5 be retained. These ranges will provide a limited airways system for the U.S. for purposes such as cross-country VFR and IFR.

Another requirement for these ranges is to furnish communication coverage in outlying areas. This service would include communications for low-altitude operations. VOR, because of its "line-of-sight" limitation cannot always fill this need.

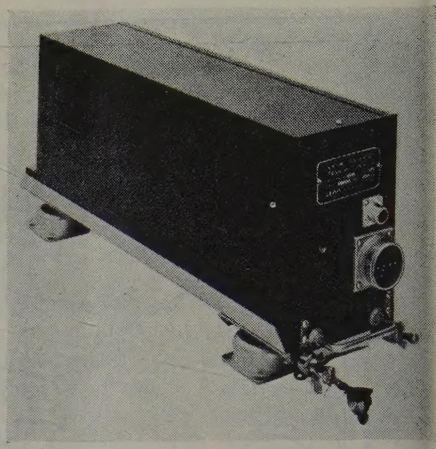
Recommendations ▶ Other ACC recommendations include:

1. Class 1 ranges should be discontinued during fiscal years of 1952 and 1953.
2. The ACC Navigation Panel's working group should determine what L/MF airways will be essential as trunk routes to satisfy interim military requirements. It should also define the functions of the Class 5 ranges. The group is asked to complete this study by fall.
3. By October 1, the NAV Panel should review the findings of the group in order to fix the date at which VOR will be declared the primary navigation and traffic control aid.
4. Expedite procurement and installation of VOR airborne receivers.

Lear LVTR-36 Available

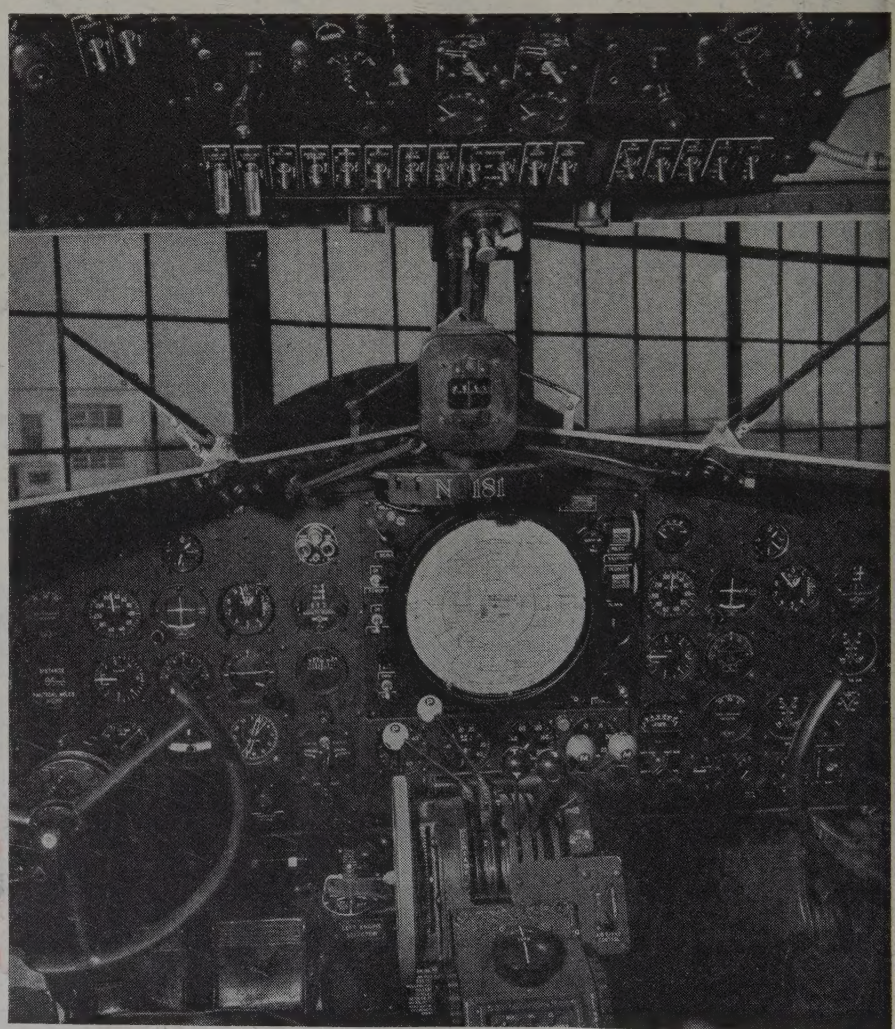
A new 36-channel VHF transmitter-receiver has been added to Lear's line of aircraft radio navigation and communication equipment.

Designated LVTR-36, it is a self-contained, remotely operated, two-way communication system consisting of a 5-watt, 36-channel VHF transmitter, a 36-channel VHF receiver, and a remote frequency selector switch that mounts on the instrument panel in the cockpit. The transmitter and receiver are combined in a shock-mounted ½ ATR rack-sized package. The over-all outside dimensions, less shock mount, are 19⅝ inches long by 4 15/16 inches wide by 6¼ inches high. The total weight including the shock mount is less than 17 pounds.



LEAR LVTR-36 is new VHF transmitter-receiver

The principal feature of the Lear LVTR-36 is that it permits radio transmission and reception automatically on the same frequency with a single setting of the selector simply by pressing and releasing the microphone button. The LVTR-36 is available for either 12 or 24-volt operation.



SPERRY MODEL B pictorial computer, described in detail in July issue, is shown here installed in Sperry's test C-47. This computer automatically plots plane's position on a map and always tells the pilot at a glance where he is. It is now undergoing CAA tests

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